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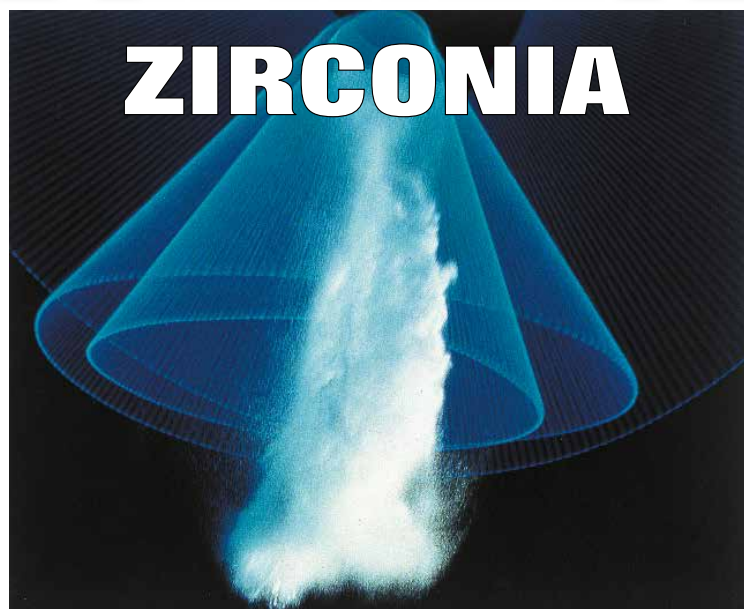
EXCELLENCE
IN CERAMICS

INTERVIEWS Heraeus/DE, ceramaret/DE **MARKET PLACE** EnCeram/DE, Lithoz/AT, 3DCERAM Sinto/FR **TECHNOLOGY INSIGHTS** Micro-Injection Moulding **EVENTS** Reviews: AM Ceramics 2022 + Design and Engineering with Hard Materials **NETWORKS** Printers from AMAREA, Advanced Ceramics Trends and Technical Ceramics Roadmap 2050

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Specification						
Y ₂ O ₃ (mol%)	3	3	3	3	8	8
ZrO ₂ (wt%)	(94.8)	(94.8)	(94.8)	(94.8)	(86.7)	(86.7)
Al ₂ O ₃ (wt%)	0.25±0.1	0.25±0.1	0.25±0.1	0.25±0.1	≤0.1	≤0.1
SiO ₂ (wt%)	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02
Specific Surface Area (m ² /g)	16±3	7±2	(16±3)	(7±2)	16±3	7±2
Typical Properties						
Sintered Density (g/cm ³)	6.05	6.05	6.05	6.05	5.90	5.90
Bending Strength R.T. (MPa)*	1200	1200	1200	1200	300	300

* 3 point Bending Test



TOSOH CORPORATION



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Dear Readers,

Technical Ceramics can provide an array of solutions for the energy transition. We will need a good mix of renewable energy. But the booming market comes with risks, too, as becomes clear if we look back at history.

Constraints on the energy market include the availability of green hydrogen, individual needs of companies, investment potential, public funding and much more. The hydrogen fuel cell market is set to be worth almost USD 27 billion by the end of the decade; companies around the world are revving up electrolyzer production, green hydrogen plants are under construction, and the industry is finally making the leap from pilot projects to industrial-scale production. To keep pace with these massive increases in demand, production will need to grow 91-fold by 2030, Bloomberg NEF estimates.

Russia's invasion of Ukraine has driven home the value of fuel that can be produced within Europe, and it has ramped up the continent's ambitions for hydrogen. And yet, some hydrogen advocates say the European Union isn't following through, putting it at a disadvantage to both the USA and China. The European Union has set a target for green hydrogen production – 10 Mt per year by 2030 – but has not yet decided which methods will qualify as “green”. That makes it hard for companies to commit to the big hydrogen production projects that would drive electrolyzer orders. Moreover, massive investment will be needed, which is not possible without public funding. Rising greenhouse gas emissions, expanding environmental concerns among the populace, and rising acceptance of environmentally friendly energy sources are also key development drivers for the biomass gasification market.

Furthermore, we have to win back market shares in international solar panel production (China 33 %, USA 13 %, Japan 8 %, Germany and India 6 % each). It's a pity when we consider that the roots for this technology are in Germany.

In better times, Solarworld/DE, a company founded in 1998, reached a value of EUR 5 billion on the stock exchange, but this dropped sharply when government funding was stopped in 2012 and installations instantly plummeted from 1800 MW to just 320 MW. In 2018, the company was forced to cease production.

In Europe, the energy transition is not a problem of our technical knowledge but of clear funding strategies to keep Europe competitive. Ceramics will make its contribution to the production of hydrogen, other technologies and energy savings, too!



Yours

A handwritten signature in black ink, appearing to read 'K. Scharrer'.

Karin Scharrer
 k.scharrer@goeller-verlag.de



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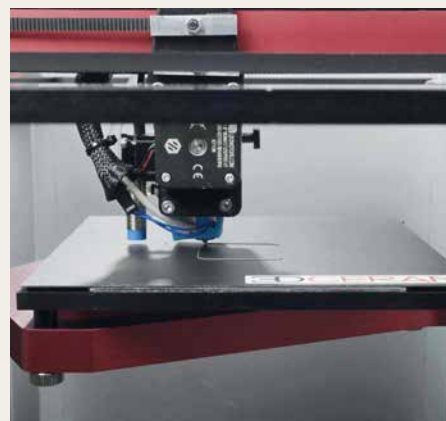


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Turbine Blades

**Most turbine blade manufacturers still mill their components.
We, on the other hand, manufacture such components using Ceramic Injection Molding.**

ceramics = expensive | That was yesterday. Ceramic Injection Molding (CIM) enables us to produce such components in a cost-effective manufacturing process close to the final shape. Our optimized injection molding process in combination with the adapted sintering process enables us to inject very thin walls, precisely and reproducibly. The sintering accuracy achieved allows us to reduce the grinding work to a minimum. Similar to plastic injection moulding, there are hardly any limits to the design. Closed cavities are currently not possible, which is the only limitation in most cases. We are often asked: can you print that too? Our answer: of course we can, but why? In many cases, we do not print the component, but the mold inserts and implement them in our multi-tools. Due to the Additive Manufacturing possibilities in the metal sector, the costs for tool inserts have become so low that they hardly play a role anymore and that makes perfect sense even with the smallest quantities.

www.qsil.com



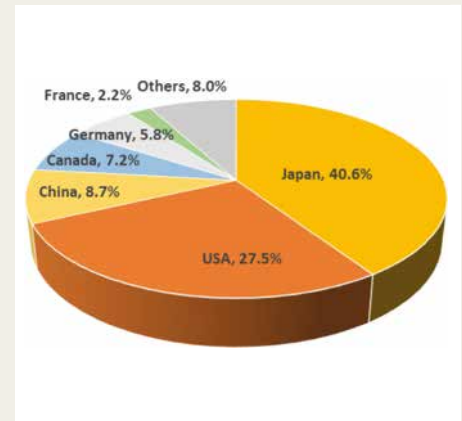
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Company News

Germany/Brazil

INMATEC Strengthens Sales in South America through Cooperation with ADDITIVA

INMATEC Technologies GmbH/DE cooperates with ADDITIVA PRODUTOS QUÍMICOS LTDA/BR to strengthen its sales structure in South America. The leading development and production company for ceramic feedstocks has an energetic, reliable, and experienced representative on the Latin American market with ADDITIVA.

With this step, INMATEC responds to the rising demand for ceramic feedstocks. These are used in Ceramic Injection Moulding (CIM) and Additive Manufacturing processes to produce ceramic components with complex geometries on a large scale. The combination of the unique material properties of ceramics and efficient series production is convincing a growing number of users in sectors such as automotive and electrical engineering, the agricultural sector, as well as in the medical, dental and jewellery industries.

With ADDITIVA, INMATEC has a reliable partner that offers an established sales struc-

ture in South America to meet the needs of the growing technology market there. Henceforth, the company from Porto Alegre, Brazil, distributes the ceramic feedstocks on the continent, manages import and shipment and is the local contact. It has more than 20 years of experience in powder injection moulding, vast expertise in the field of ceramics and is well connected in the Latin American industry. ADDITIVA strengthens INMATEC's presence in this region by providing a local technical and commercial service with skilled on-site specialists.

INMATEC continues to grow: the reinforcement of activities in South America is the second major sales expansion within a few months, following the strengthening of the distribution structure in Eastern Europe regions in June 2022. To meet the growing demand for ceramic feedstocks, INMATEC had recently also expanded production capacities and increased its workforce.

<https://inmatec-gmbh.com/>,
www.additiva.com.br/

Germany

CeramTec Plans Expansion at the Marktrechwitz Site

The advanced ceramics manufacturer CeramTec is planning to expand its presence at the Marktrechwitz site. The already existing manufacturing complex is to be expanded in the coming years to include, among other things, a further production hall.

Dr Hadi Saleh, CEO of CeramTec said: "Our well-filled order books make it necessary for us to expand capacities. At the Marktrechwitz site, we have already been able to count on an extremely reliable and sustainable network of employees and partners in the past. We are therefore pleased to be able to further expand our presence in Marktrechwitz and thus also play an even more important role as an employer in the region in the future." CeramTec currently employs more than 800 people at its Marktrechwitz site. Among other things, the new building is to be designed with a special focus on sustainability aspects.

"In the CeramTec Group, we introduced measures for an even more conscious use of energy some time ago and have already implemented various projects and measures. The new building offers us excellent opportunities to produce even more energy-efficiently and sustainably in the future and thus make an important contribu-

tion to the energy transition in Germany," said Dr Saleh.

www.ceramtec.de

Germany

Carbon Recycling: Fraunhofer IKTS Expands its Freiberg Site

As of 1 January 2023, Fraunhofer IKTS has integrated the Freiberg Research Group Circular Carbon Technologies KKT. By doing so, the institute aims to leverage further synergies in electrolysis, hydrogen and power-to-X technologies and to develop sustainable carbon sources for circular economy. Large quantities of CO₂ are released both during the production of these raw materials and when they are burned at the product's end of life. Germany alone incinerates around 47 Mt of this carbon-containing waste each year in thermal waste treatment and combustion plants. In the future, up to 100 % of this waste could be recycled and used in new products through precisely coordinated process combinations in chemical recycling. Waste will thus become a valuable source of raw materials, for example for feedstocks in the chemical industry.

At the new site in Freiberg, chemical recycling processes such as pyrolysis or gasification are optimized and tested on a near industrial scale. Plastics that cannot be further recycled mechanically, biomass or mixed fossil waste are broken down into smaller molecules so that they can be reused as synthesis gases, monomers or other intermediate products in the chemical industry. For this purpose, the researchers at the site operate a pyrolysis platform and – in cooperation with the TU Bergakademie Freiberg – gasification facilities to investigate various issues: which waste fractions can be converted into which kinds of basic materials? How must the processes be run in order to avoid corrosion or caking or to achieve a certain purity of the products? And finally, there is also the question of economic feasibility. In this way, various technologies can be adapted, evaluated and transferred into customer-specific solutions for closing carbon cycles for industrial partners.

These competencies will be expanded in the future. Prof. Martin Gräbner, Head of the new site in Freiberg and Chair of the Energy Process Engineering and Chemical Engineering at the TU Bergakademie



Fig. 1
Headquarter of ADDITIVA PRODUTOS
QUÍMICOS LTDA in Brazil

Freiberg, explained: "In the future, we want to realise the use of carbon sources in a way that is as low in CO₂-emission, as efficient and resource-conserving as possible. The basis for this must be renewably generated electricity, which is incorporated, for example, as green hydrogen via special synthesis processes. This is where we optimally tie in with the competencies at IKTS." If the recycling processes mentioned are combined with electrochemical conversion processes such as high-temperature electrolysis or synthesis processes such as Fischer-Tropsch synthesis, higher-value products such as synthetic kerosene can be produced on the one hand and high efficiencies can be achieved on the other.

Only the coupling of material, energy and heat flows combined leads to process concepts that offer significant added value compared to previous approaches. Prof. Alexander Michaelis, Institute Director of Fraunhofer IKTS, was pleased about the new addition in Freiberg and described the associated potential: "IKTS has many years of experience with technologies for hydrogen production and utilisation. Here, high-temperature electrolysis and Fischer-Tropsch synthesis are absolute core technologies. With the expanded expertise in the field of circular carbon technologies, we are now in a position to provide new raw material and energy resources for a green industry."

www.ikts.de

France/Great Britain

Saint-Gobain's Advanced Silicon Carbide Pipes for Thermal Cracking Technology

Advanced thermal cracking technology transforms a wide range of non-recyclable and hazardous wastes into a clean synthesis gas (syngas) and biochar. As it doesn't burn waste, the process has very low emissions. Tar-free, the syngas of company Standard Gas, achieved the End of Waste certification from the GB's Environment Agency. It can be used to generate electricity, and heat, or processed via methanation into transportation fuels, chemical feedstock or for grid injection. Coupled with electrolysis or via reformation, the SG100 can generate between 650–3000 t of green hydrogen a year. The co-product biochar captures and removes carbon when used in sequestering applications such as soil conditioning or

as an aggregate for construction materials such as concrete and asphalt.

Saint-Gobain's advanced silicon carbide, pipes are ideal for this process and have higher heat resistance than steel and metal alloy alternatives. After approval the commercial-scale demonstration plant in Cambridgeshire/GB, the scaled-up plant is under construction. Capable of processing 48 000 t of waste a year, the SG100 can generate an average of 40 000 MWh of power and, dependent on feedstock, remove up to 16 000 t of CO₂. With a small footprint, the plant can be deployed in a modular manner, making it rapidly scalable for a range of end-use applications.

www.ceramicsrefractories.saint-gobain.com

Germany/India

Strategic Investment by OYAK to India

Almatis/DE, a member of OYAK Group of companies, has put into operation its tabular alumina facility, which it has integrated by equipping it with new technologies, in the Falta region of India. Falta investment is just a beginning.

OYAK General Manager Süleyman Savaş Erdem said: "We have taken great steps in the recent years with the vision of becoming a global player. Our Falta investment is proof of OYAK's power and greatness."

The world's largest alumina producer Almatis, a member of OYAK Group of companies, has integrated the tabular alumina plant in the Falta region of India. OYAK will grow in the Southeast Asian market with the Falta facility, where semi-finished products will be produced from now on.

The tabular alumina plant in Falta, which OYAK has integrated backwards, has been a fitting response to the "Make in India" call of the Indian government for producers. With this investment, Almatis has integrated the entire tabular alumina production process in India, where it previously supported some of its production with own global operational network and has been operating since 1995.

Established on a total area of 32 300 m², the development process of the facility with the latest technologies was completed in approximately 2,5 years. OYAK General Manager Süleyman Savaş Erdem stated that the new investment of Almatis is a result of OYAK's vision and growth strategy. Focusing on foreign investments in the sectors it has been oper-

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ating in the recent period, OYAK expects its Falta facility to contribute USD 40 million to its turnover in the first stage.

Süleyman Savaş Erdem said: "While we were defining OYAK's future vision, we set the goal of becoming a global player. In the recent years, we have taken strong steps to achieve this goal in line with our growth strategy. Today, we produce uninterruptedly 24 h a day in different sectors and maintain our leading role in the fields in which we operate. We are proud of the success we have achieved by putting our strategic decisions into practice.

Our integrated production facility in India is the concrete proof of OYAK's power and greatness."

OYAK General Manager Erdem emphasized that Almatris will increase its production volume in India, which is considered a virgin area in the refractory market, with this investment. He said: "We have implemented the Falta facility in a large geography such as India, one of the fastest growing countries in the world, with the understanding of the right investment in the right market. We will meet the demands of the Southeast Asian market

with tabular alumina to be produced at the facility."

OYAK's investment in Falta will be an important milestone for the supply of tabular alumina to the Indian market. By localising its operations, Almatris aims to be more compatible with the Indian market, thus managing fluctuations in market demand more successfully. The Falta investment is the beginning of Almatris' efforts to expand its operational footprint in the Indian market, which was once seen as a "big leap".

www.almatris.com



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GERMANY

Heraeus High Performance Coatings: Aerosol Deposition – a Revolutionary Process for Ceramic Coatings

Heraeus High Performance Coatings is a start-up of the Heraeus Group, which is headquartered in Hanau/DE. Heraeus is made up of numerous businesses in environment, electronics, health and industrial applications. Customers benefit from innovative technologies and solutions, based on broad material expertise and technology leadership. In the 2021 financial year, the Group generated a consolidated turnover of EUR 29,5 billion, with around 16 200 employees in 40 countries. We spoke to Dr Ilka Luck (IL), Head of Heraeus High Performance Coatings.



Fig. 1
Dr Ilka Luck, Head of Heraeus High Performance Coatings

CA: When was Heraeus High Performance Coatings established?

IL: High Performance Coatings originates from a development team formed back in 2019, which has grown considerably in the meantime and, on the back of very promising development findings and huge market potential, has now

been launched as a start-up. Our business model is based on a novel coating method – Aerosol Deposition (AD). This enables the production of unique ceramic and metal coatings at room temperature on a diverse range of substrate materials. We offer coating services and production technology tailored to individual customer needs. As we have come on really well in recent times, setting up a production site, if possible in the greater Hanau region, is already on the agenda for 2023.

CA: How were these activities initiated?

IL: The technology developed in Japan has so far been applied mainly in Asia for the coating of components for plasma etch chambers in the semiconductor industry. Although the coating method offers many benefits, outside the semiconductor industry, it has hardly been used on industrial scale up to now.

Heraeus has discovered AD for its high-temperature sensors. With the help of AD coatings, their service lifetime can be lengthened and they can be used at higher temperatures. Over the last three years, we have worked intensively to optimize processes and machines for production on industrial scale. During this time, we have received lots of enquiries from all over the world about applications in e-mobility, semi-conductors, (power) electronics and protective coatings (corrosion, abrasion, and scratch resistance). Our focus is now on applications for electromobility, followed by the semiconductor industry and protective coatings. We

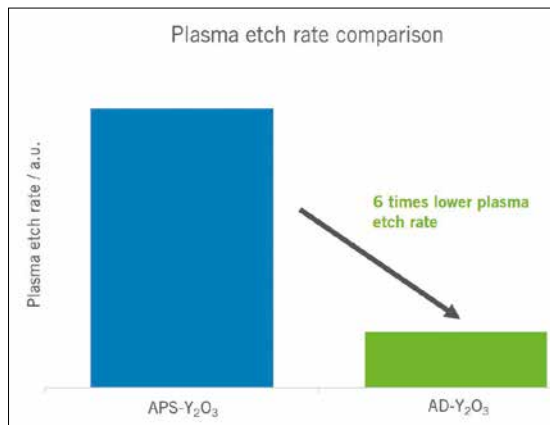


Fig. 2
Aerosol Deposition

are currently the only supplier able to support customers from an initial feasibility study to series manufacturing.

CA: Please briefly describe the process to us.

IL: AD works on the basis of room-temperature impact consolidation. A carrier gas is used to aerosolize μm -sized particles of the ceramic or metallic coating material, which is introduced into a vacuum coating chamber. The aerosol is accelerated to several 100 m/s and sprayed onto a substrate surface. Because of their high kinetic energy, the particles fracture into small fragments, which form a cohesive layer. The achievable layer thicknesses range from 1–70 μm depending on the material/substrate combination. The good adhesion and stability of coating can be attributed to the fact that the substrate and coating enter into a chemical bond at the point at which they meet. The obvious advantage of this method is that a wide range of materials



Fig. 3
Aerosol Deposition enables the formation of unique metal and ceramic coatings at room temperature on all types of material surfaces

(ceramic, metals and their combinations) can be coated onto diverse substrates (metal, glass, ceramics, hard plastic, and semiconductor) in low vacuum. Durable material-substrate bonds that were previously not easy to obtain can be produced. The coating layers themselves are very compact, almost the density of the solid material can be matched without downstream temperature treatment. They exhibit high resistance to chemical and mechanical loads.

Another special feature of AD ceramic coatings has been demonstrated to be its dielectric strength. This is higher than might be expected based on the volume properties

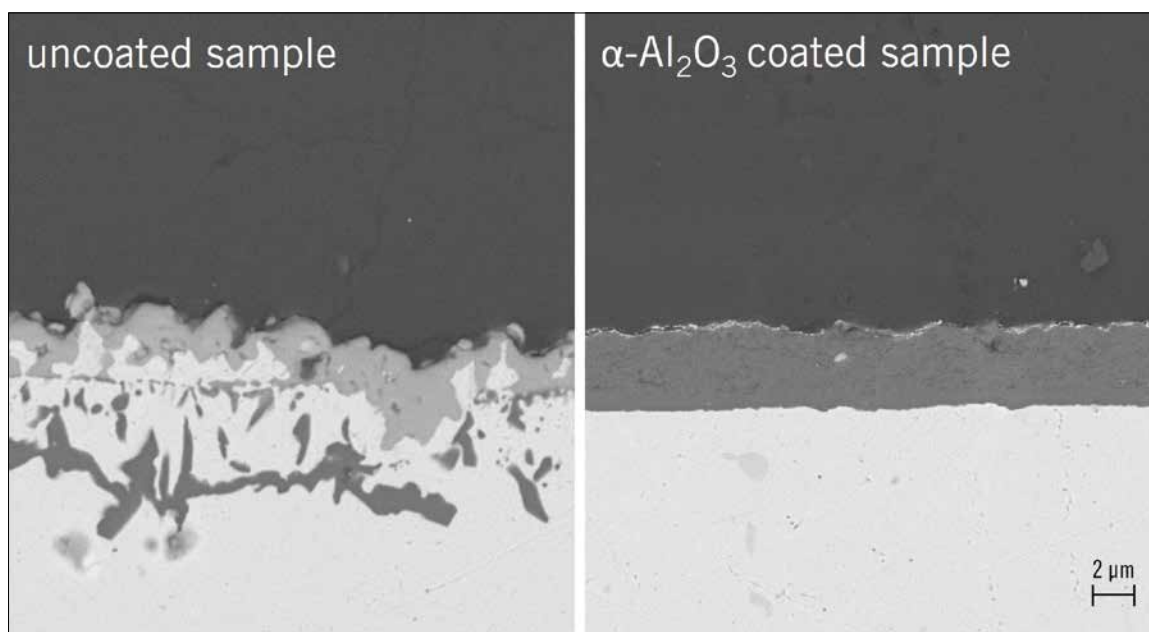


Fig. 4
 $\alpha\text{Al}_2\text{O}_3$ coated sample (r.) vs. uncoated sample

of the respective material. Fundamental research has not yet come up with a substantiated explanation for this, but repeated performance tests have proven that coatings of 20–30 µm can reach 2–3 kV dielectric strength.

CA: *What are the key advantages of AD compared with other coating methods?*

IL: Compared with all other coating technologies, AD can be performed at room temperature and at low vacuum. This is ideal for materials and substrates that are not temperature-resistant, and enables completely new combinations of coating and substrate. The deposition rate is much higher than for ALD or PVD processes. These two advantages together make AD a cost-efficient and environment-friendly coating processes. In comparison with thermal spraying, two process steps can be eliminated. Pre-treatment of the substrates to enable adhesion of the coating is not necessary. Polishing of the coating surface after deposition is not necessary either.

CA: *What materials do you currently see as suitable for coating?*

IL: Our portfolio comprises numerous ceramic (alumina, yttria, aluminium nitride, silicon nitride, magnesium-rein-

forced zirconia, zirconia-reinforced alumina, etc.) and metallic coatings (silver, copper, tin, and tungsten). Material composites are also possible.

The focus of our work is ceramics as these materials are used in electric insulation, thermal management and protective functions.

We are currently coating planar and rotationally symmetrical parts. We are also working on progressing to more complex parts, the customer with their individual requirements always being our central priority.

CA: *How do you proceed when a customer wants to integrate AD in their own manufacturing process?*

IL: Heraeus High Performance Coatings supports its customers from initial feasibility studies to the introduction of the process in their own production line.

Our Application Centre with three coating systems is therefore very important to assess and process projects. Thanks to the Heraeus Group's international network, we are making good progress here. We are currently delivering a system to Taiwan.

CA: *Thank you for talking to us.*

KS

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ceramaret's Successful Development in Meissen – 25-Year Company Anniversary

ceramaret AG, based in Bôle/CH, acquired shares in MicroCeram GmbH in Meissen/DE in April 2018 and announced a name change to ceramaret GmbH in June 2020. ceramaret AG's strategy is focussed on growth, which it aims to achieve not only with steady organic growth, but increasingly with external growth. On 1 January 2022, Andreas Ziegert (AZ) took over the management from the company founder, Mathias Wilde. Andreas Ziegert had already been working for 20 years at the Meissen base and had held the position of Production Manager in the last few years. The company's portfolio comprises oxide ceramic components made of alumina and zirconia as well as non-oxides such as silicon carbide and silicon nitride. He agreed to tell us about the development of the Meissen base under ceramaret AG.

CA: *Since 2020, industry has been facing very difficult circumstances (COVID crisis, supply chain problems, war in Europe). How has the Meissen base fared over these last few very challenging years?*

AZ: Very well actually, despite the circumstances. We have doubled the workforce to over 80 in the last five years, with corresponding growth rates in turnover.

CA: *Is that down to synergies between the sites and special positions in the market?*

AZ: To a large extent, Bôle and Meissen operate in the same market segments. Focuses are analytics as well as aesthetic products (watches, jewellery) as well as medical technology, sensor systems and wear parts for mechanical engineering. We have established that there is certainly some overlapping among our customers. Each of the manufacturing sites, however, is generally represented with different products, which is now enabling us to serve customers with a much more complete portfolio.

CA: *Has the new owner invested in the Meissen site to enable the growth you have mentioned?*

AZ: The machine park for all important manufacturing steps has been extended (presses, green and hard-machining centres, furnace engineering) and a further production facil-

ity has been built. Investment projects are driven forward very strategically – that has certainly stimulated the momentum of our development.

CA: *Does the production operation in Meissen have particular technological strengths?*

AZ: We have seen again and again that an approach originally introduced for making prototypes has turned out to be a real strength with regard to quality especially for very complex and, in some cases, very thin-walled components. Instead of manufacturing these using CIM, we manufacture certain components, actually more cost-intensively, by means of dry pressing with downstream isostatic pressing. The green components are then machined in a complex process, sintered and, if necessary, hard-machined. With this process, we achieve high sintered densities and accordingly strengths superior to those obtained with other technologies. This is how we are able to set ourselves apart from other players in the market.

Another advantage of this manufacturing strategy are the manageable initial costs and much shorter development time. Moreover, we are able to manufacture components with the highest precision, which is especially important in the analytics user segment. For the watch and jewel-

lery industry, we can also produce exceptionally high-quality surface finishes, if required with through-coloured ceramics.

CA: *Has it been difficult to recruit new skilled workers?*

AZ: It is becoming increasingly difficult. With dual training opportunities in all relevant production areas, we try to support employees and applicants and to encourage employees with other measures. In addition, we are continuously training new specialist employees.

CA: *How have the difficult conditions mentioned at the beginning affected your business activities?*

AZ: We buy in ceramic bodies and feedstocks, and here we have to plan in a longer term. Sales are currently very buoyant, but it's not always clear whether the customers are buying to stock, which could lead to a downturn later.

As we operate exclusively electric furnaces, gas consumption in the company is low. We are already studying projects to enable us to cover our own power requirements, at least to an extent.

Energy saving is an ongoing issue. In this connection, we have achieved a very positive outcome with the centralization of the coolant systems and energy recovery for the

compressor system in the facility. Extremely critical is when maintenance is needed for which we have to call in external operatives. Here, we have noticed the lack of skilled workers in a different context. We cannot offset all our suppliers' price increases, so unfortunately we have to pass on part of these to our customers.

CA: *At the company's 25th Anniversary in autumn, Mathias Wilde planed to finally retire. How are you going to compensate for him leaving?*

AZ: Over the last few months, he has mentored me, giving me marvellous support. In addition, he has looked after research and development projects. His experience, his intuitive feeling about which new products are bound for market success, all that can't be simply transferred. But he will certainly remain on hand where necessary with advice and practical support.

In the meantime, we have a joint development team at Bôle/Meissen, which works in coordination for the two sites. As a former Production Manager, I have, of course, learned a lot from him in many areas. I have been able to transfer my work in production to my former.

CA: *Thank you for talking to us.*

KS

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HIGH PRECISION PARTS IN ADVANCED CERAMICS



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EnCeram – The New CIM Binder and Feedstock Provider

EnCeram develops, produces, and distributes proprietary binder systems and feedstocks for the Ceramic Injection Moulding (CIM) process.



Fig. 1
CIM feedstock – EnCeram SW AL

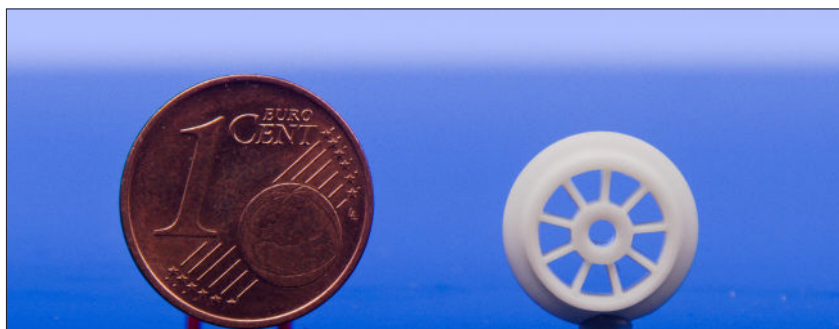


Fig. 2
Ceramic made of EnCeram SW AL, part weight <1 g

EnCeram is an internal start-up of the Chemische Fabrik Budenheim/DE. The Chemische Fabrik Budenheim is a specialty chemicals company in the life and material science sector. As a leading global manufacturer, Budenheim's products stand for innovation, customer proximity as well as reliability in quality. As part of the fam-

Keywords

CIM, feedstock, binder, water debinding, aluminium oxide, zirconium oxide

ily business Geschwister Oetker Group, Budenheim is interested in long-term, sustainable customer partnerships. Being part of the Budenheim Group, EnCeram applies the mindset of a chemical company to Ceramic Injection Moulding (CIM) and leverages Budenheim's specialty chemicals expertise in areas such as polymers and ceramics. As an internal start-up, a dedicated team focused on satisfying customer needs in Technical Ceramics, especially CIM, has been formed.

Accordingly, the claim is: "We Enable your Success in Technical Ceramics". Together with partners and customers, the aim is to develop the best solutions and deliver the highest quality permanently.

The first products in the portfolio are the binder system EnCeram SW and the related feedstocks with aluminium oxide and zirconium oxide, EnCeram SW AL and EnCeram SW ZR. During the development, a constant dialogue with establish experts and users along the value chain was established to ensure the perfect design of these products. EnCeram SW is a binder system specially designed to ensure excellent adhesion to oxide particles, improved flow, and low tackiness to the injection moulding tool. In addition, EnCeram SW is partially soluble in water, which enables easy, fast, and environmentally friendly two-step de-binding process using water as solvent and a clean burn out thermally without leaving residues. These feedstocks are characterised by very good injection moulding, debinding and sinter characteristics. Already different parts with weights between <1 g and 100 g have been made successfully. EnCeram SW, EnCeram SW AL and EnCeram SW ZR are free from impurities and are consistent provided in high quality, not least due to the backward integration of the production process and the company's quality management measures. The production is in the Netherlands at Vaassen, adjacent to Budenheim's Center of Excellence of Polymers. This set-up enables EnCeram to be agile in responding to customer needs in the future. As producer of both binder and feedstocks, the company is in control of composition and quality of the binder.

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In this Technical Center, the whole value chain is covered. There is access to different kind of processes, like kneaders, shear-roll extruders, and extruders. Injection moulding machines from relevant manufacturers are used to find suitable injection moulding parameters. Debinding furnaces for developing the thermal debinding procedure are available as well as suitable furnaces for sintering the components.

The highest standard of quality is a heritage of Budenheim's being a long-time trusted partner in the pharmaceutical and food sectors. Consequently, EnCeram has access to an array of different analytical methods e.g. particle size analysis, BET, XRF, XRD, chemical analysis (ICP-OES), FT-IR, and TG/DTA to control the quality of the products.

The team from EnCeram is committed to establish close partnerships with customers and would be delighted to be part of their value creation according the slogan: "We Enable your Success in Technical Ceramics" – Take us at our words. Let's get in contact and start innovating together!

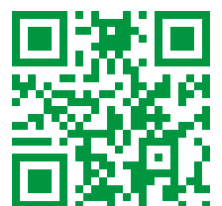
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3D Printing Ceramic Tubes with Complex Inner Structures and Minimal Wall Thicknesses of 200 μm at an Industrial Scale

Digital mass production in 3D printing combines flexibility in design with the many evident efficiency benefits of tool-free manufacturing and is about to establish itself as a fully-fledged production method for industrial applications, offering specific added value to the ceramic industry. This use case describes how German ceramic AM specialist Steinbach AG successfully set the parameters for the serial production of 12 000 parts with complex inner geometries per year.



Fig. 1
The Steinbach Technical Ceramic 3D printing team receiving their fourth Lithoz printer, the CeraFab System S65, for industrial production

Industrial serial production of ceramic components

As the market-leading producer of innovative Lithography-Based Ceramic Manufacturing (LCM) technology, Lithoz/AT has

Keywords

serial production, ceramic 3D printing, LCM technology, medical applications, machine park

enabled a wide range of previously unimaginable applications in the industrial field, medicine and beyond.

Steinbach, who is considered one of the pioneers in the use of Additive Manufacturing (AM) for the mass production of high-performance Technical Ceramics, is just one example of a company who has used LCM technology to drive its innovation further. This case study describes the compa-

ny's journey to the successful and profitable manufacture of a new type of ceramic tube with complex geometries, which Steinbach achieved with an annual production rate of 12 000 units and comparable reject rates to conventional manufacturing technologies. With the recent addition of a 4th Lithoz 3D printer to its machine park, Steinbach has established itself as a leading ceramic AM service provider.

In the summer of 2017, the Detmold, Germany-based Steinbach received a request from a renowned manufacturer of medical products to produce a ceramic tube. This tube was to be used as a guide element in a newly developed surgical instrument.

After testing the first component produced using the Lithoz CeraFab 3D printer, the customer opted to have Steinbach develop and produce the part using the LCM process of technology provider Lithoz GmbH. The production of these complex tubes,

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Fig. 2
The CeraFab System S65
for industrial production



Fig. 3
Now with four Lithoz LCM printers, Steinbach extended its production capacity to react to the increasing order volume

which could not be made using traditional manufacturing processes, had to fulfil some very challenging objectives to satisfy the business goals of the customer. A concrete goal for the manufacturing costs, as well as a tight deadline of six months to enter into production, formed the general framework of the project. The clearly pioneering aspect within the field of ceramic 3D printing was using the established LCM technology at an industrial scale. Steinbach's particular aim was to guarantee the scalability of the production process while maintaining consistently high part quality throughout.

Key features of the part and requirements of the series project

The main challenges which Steinbach faced at the beginning of the project were meeting some of the dimensional parameters defined in the production order. The realisation of an entirely new tube geometry with sharp bends and inner contours, minimal wall thicknesses of 200 µm, as well as perfectly singular surfaces with roughness values of $Ra_{\max} = 0,4$, required the innovation value provided by this new LCM solution. Using conventional manufacturing technologies, it was not economically

feasible to achieve the necessary narrow tolerance of +20 µm in the outer geometry with a reproducibility of 12 000 pieces per year.

In order to meet the customer's economic expectations, Steinbach had to reliably transfer the excellent material properties achieved in the first parts, made using LCM technology, into large-scale serial production. Implementation took place in three phases, with a focus on key criteria such as productivity, process stability, quality assurance and economic efficiency.

LITHOZ

We are ceramic 3D printing.

THE ANSWER TO DIGITAL MASS PRODUCTION



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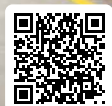
INDUSTRIAL



MEDICAL



CERAFAB SYSTEM



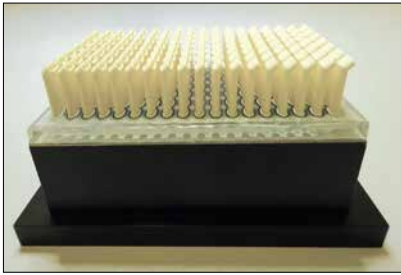


Fig. 4
Production of these 126 complex ceramic tubes was not economically viable using conventional manufacturing methods

Shortcut

Task

Production of high-performance ceramic tubes in batches of 12 000 per year.

Material

LithaLox HP 500 (aluminium oxide).

Solution

AM-compatible design and implementation on a Lithoz CeraFab system.



Fig. 5
The tubes, with sharp bends and inner contours, were defined and produced with minimum wall thicknesses of 200 μm , as well as perfect surfaces with roughness values of $Ra_{\text{max}} = 0,4$

Benefits

Economical series production of ceramic tubes, with geometries which cannot be produced using traditional manufacturing processes.

Phase 1 – finding a suitable part design for LCM Technology

Using consistent Design for Additive Manufacturing (DFAM) of the complex geometry, Steinbach worked closely with the customer to guarantee full functionality of the tubes throughout the serial production of thousands of components.

The functionality of the prototypes developed was always thoroughly tested under near-series printing conditions, ensuring that the component quality was ready for serial production from the very first part. Product validation was carried out at the customer's premises, concluding the first phase of the project with the customer's approval of the printed part geometry.

Phase 2 – scaling the process for industrial mass production

Subsequently, Steinbach's technical ceramics team focused on the details of process optimization, to ensure the reproducibility of part properties in mass production without any loss of quality. To achieve this, every available potential of LCM technology had to be fully explored and exploited. Software upgrades such as guaranteeing pixel-precise alignment of the components were carried out in close cooperation with Lithoz. Systematic control measures were introduced to ensure consistent set up of the manufacturing process.

After achieving solid production results, further measures were then implemented step-by-step to increase productivity – for example, by optimizing the part cleaning sequence and developing a more efficient loading of the furnace to achieve better thermal processing. The data obtained throughout the process optimization served as an analytical basis for quality assurance and as a statistical basis for rational

decisions in future projects. After a process audit was carried out by the customer, the final milestone of the second phase was reached.

Phase 3 – ramp-up of series production with economic optimization

Six months after receiving the order, Steinbach delivered the first serial production batch of components on time. By July 2019, in line with growing customer demand, the full production volume of 12 000 tubes per year was reached. Each new adaptation was subject to customer approval of the resulting sample. By continuing to increase the efficiency of the process, as well as tailoring further development of the material, the Steinbach team was able to repeatedly reduce manufacturing costs, minimising scrap to achieve the specified target range.

Successful completion of the project

By establishing the economical production of 3D-printed ceramic components (as described above), Steinbach took a decisive step from theory into business practice. Thanks to consistent optimization of the entire manufacturing process, Steinbach successfully implemented serial production using LCM technology and achieved the expected Return On Investment (ROI) across the entire value chain.

In this project, the Steinbach team gained complete competence across the entire production process – all the way from part design through post-processing to the finished sintered component. Subsequent customers have greatly benefited from this tried-and-tested user knowledge, along with Steinbach's efficient quality management and high delivery performance. Thanks to the success of this foundational project and a machine park of four Lithoz CeraFab 3D printers, today Steinbach holds one of the leading positions in the AM serial production of high-performance technical ceramics for industrial and medical applications.

M.A.T: The Next Generation of Ceramic FFF and More

When the American company Stratasys' patent for the filament-based 3D-printing expired in 2009, few would have thought that the desktop 3D-printer or the FFF (Fused Filament Fabrication) printers would become so widely adopted, and in such a short time. By 2019, FFF of thermoplastic has become a well-established technology for prototyping and manufacturing, and less than half a decade later, we are now witnessing the ascension of FFF of ceramics and metals to the mainstream of 3D-printing and manufacturing technologies. The technology of FFF which started of with the most commonly-used plastics like PLA, ABS, PETG, etc. is now capable of manufacturing Technical Ceramics like SiC, alumina, zirconia, and the list goes on.

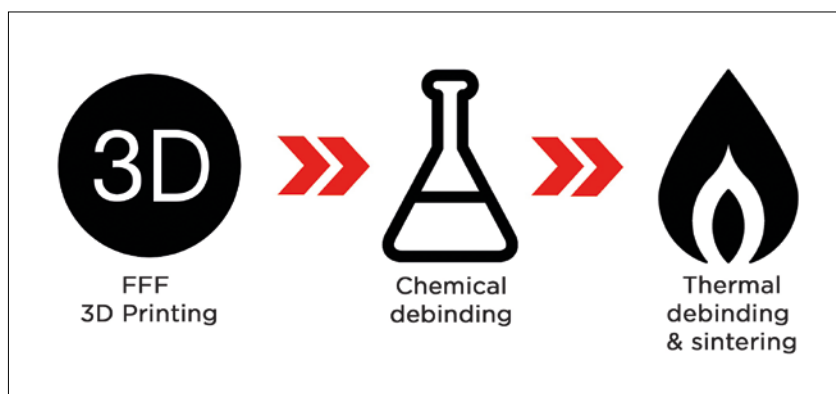


Fig. 1
The entire process for 3D printing of ceramics parts using the FFF technology

A look on the FFF side of this new technology to see how it works for ceramics

Just like the FFF printers, you might have seen in the workshop of 3DCERAM Sinto/FR, that this process also uses filament albeit with high volumetric loading (around 50 %) of fine ceramic powder dispersed in a thermoplastic matrix. Once the shaping has been done with the FFF printer, the

“green” parts are then subjected to debinding (process of elimination of binder), followed by sintering (process of compacting the fine ceramic powder) to obtain a pure part of ceramic.

The shaping process for ceramics – although very similar to the thermoplastic filaments – does tend to differ from the usual FFF process you might be implementing in your workshop. One of the main differences as compared to the thermoplastic filaments is that the filaments are much more brittle and soft – compared to those of PLA for example – and do not bend so

easily – at least not without breaking. This demands an extruder motor and extrusion mechanism that extrudes these filaments carefully while making sure that it still has enough torque to overcome the viscosity to push the melted liquid out of a fine nozzle that can be as small as 0,3 mm in diameter. In addition, the filaments of most Technical Ceramics tend to melt at temperatures that can be lower by 50–100 °C as compared to plastic FFF materials. They soften already at temperatures of 40–50 °C.

This means that while the filament warms up close to nozzle, it has to be cooled everywhere else. In addition, there are numerous other fine points that need to be taken care of, like the choice of suitable abrasion-resistant material and size of nozzle, extrusion parameters that are significantly different to those of the thermoplastics, slicing algorithms to reduce the internal stress in body during shaping, and so on.

The list can be long and cumbersome, and as a new technology user the path to the

Keywords

fused filament fabrication, multi additive technology, 3D printing of ceramic parts

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<https://3dceram.com>



Fig. 2
M.A.T. is a versatile machine with a robust structure able to house several shaping technologies

Salient features of M.A.T.

- Printer type: Fused Filament Fabrication
- Footprint: 60 cm (W) × 60 cm (D) × 115 (H) cm
- Print volume: 20 cm (W) × 20 cm (D) × 20 cm (H)
- Machine weight: ca. 75 kg
- Supply: 230 V, 16 A, 50 Hz
- Machine housing: steel, powder-coated
- Number of printing head: 1
- Filament diameter: 1,75 mm
- Max. nozzle temperature: 270 °C
- Max. bed temperature: 115 °C
- Chamber/part heating: radiative, 500 W
- Max. chamber temperature: 60 °C
- Option: 3-staged closed loop filtration system
- Compatible with Cura (recommended)/Slic3r/Simplify 3D
- Suitable for: ceramic filaments, SiC, alumina, zirconia
- Metal filaments: titanium, stainless steel, copper

perfect part could be long (and may be slightly frustrating) – and that is why M.A.T. is here to your rescue.

M.A.T., short for Multi Additive Technology, is a dedicated 3D printer for ceramics. The many features like water-cooling of the heat-sensitive filament extrusion head, closed-loop motor control for the X-Y-Z-drives of the printer, direct radiative heating of the printed parts to enhance layer adhesion, etc. means that the elusive perfect part is not so elusive anymore, and just a few clicks away from being printed and thrustured into its desired application. The ba-

sic version of M.A.T. – which was launched in November 2022 at formnext – currently enables production of ceramics like SiC, alumina, and zirconia. The premium package can extend its capability to metal like stainless steel, titanium and copper.

M.A.T. – new, versatile and flexible shaping machine

In addition to FFF, M.A.T. takes the possibilities with extrusion-based technologies a step further through two additional processes, i.e. CNC machining and robocasting.

CNC machining/milling

The sturdy frame of M.A.T. enables users to quickly swap the head – once they are done with printing – and replace it with a CNC tool. The 3-axis CNC tool can then be used to further refine the printed part – for example contour milling to improve its surface finish, plane milling to improve its flatness, or simply some basic machining to improve the resolution of its functional elements.

The result is a part that has been successfully machined without the need for further post-processing after sintering.

A special mention needs to go out to the fact that treating ceramics after printing/before sintering or in their green state – when they are soft – is much easier and economic than to perform these operations once they are sintered (after sintering, ceramics like SiC tend to demonstrate diamond-like hardness, which as you can imagine can make machining quite challenging).

Robocasting

Robocasting on the other hand is a well-established process, ceramicists use to extrude ceramic slurry through a nozzle. Robocasting has the advantage of not requiring a precise filament manufacturing process at the cost of reduced extrusion control and higher surface roughness.

Again, through the quick swap of head you can go from FFF to robocasting – depending upon what your project demands. Just like FFF green parts, the quality of the robocast-

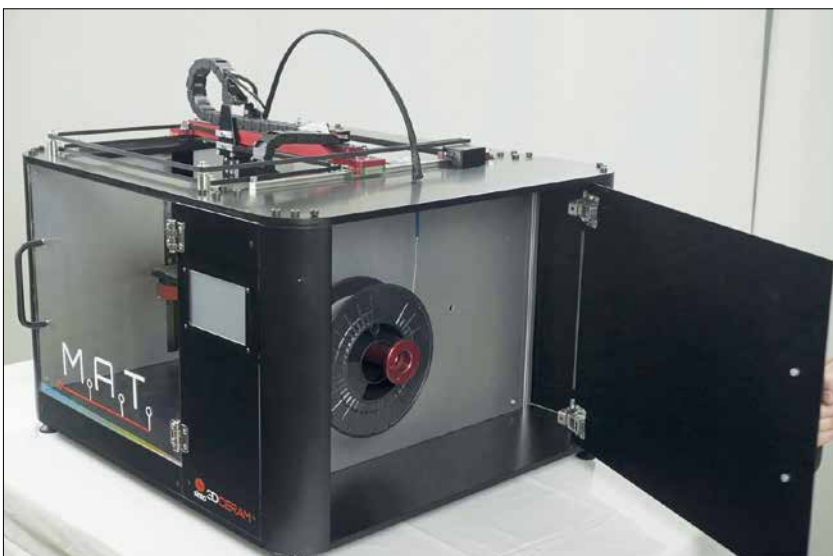


Fig. 3
M.A.T. in its basic version for 3D printing with FFF

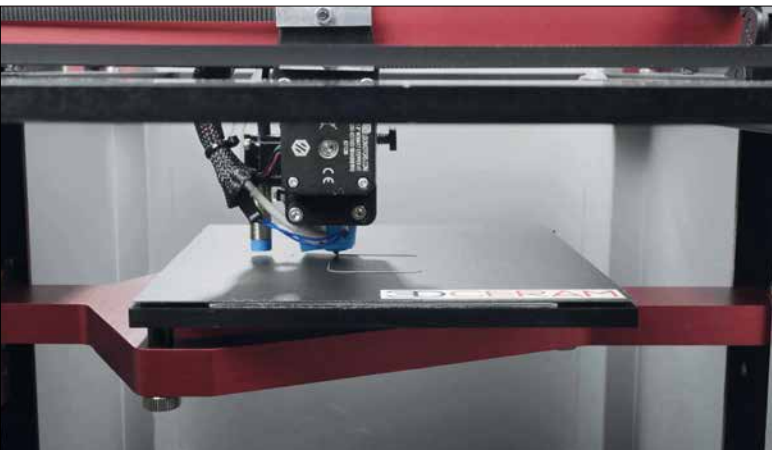
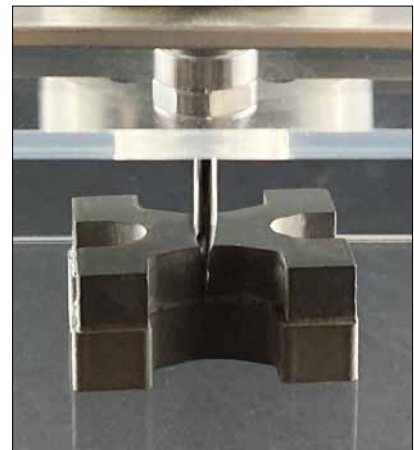


Fig. 4
M.A.T. has been developed to provide an option for 3D printing parts with SiC



Figs. 5–6
CNC head to obtain a perfect surface finish on the green part

ing green parts can be further enhanced through the quick swap of head to CNC machining. While you can custom-develop your own slurry, just like the filaments, 3DCERAM Sinto can also provide you our own ready-to-use slurry for robocasting.

Conclusion

If you are a ceramicist and are looking for a fresh but most of all versatile and flexible new machine for your workshop to help with the ever-changing demands of your projects, then M.A.T. is the answer. Combin-

ing the two most used 3D-extrusion technologies complemented with green machining, M.A.T. makes a very strong case for prototype development of applications as well as applications requiring small-series of complex ceramic parts.

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Micro-Injection Moulding Puts Ceramics in Top Form

Ceramic Injection Moulding (CIM) enables the economical production of ultra-precise parts with maximum freedom of design regarding geometry and material properties. As a result, a wide range of industries benefit from the advantages of the high-performance ceramic materials.

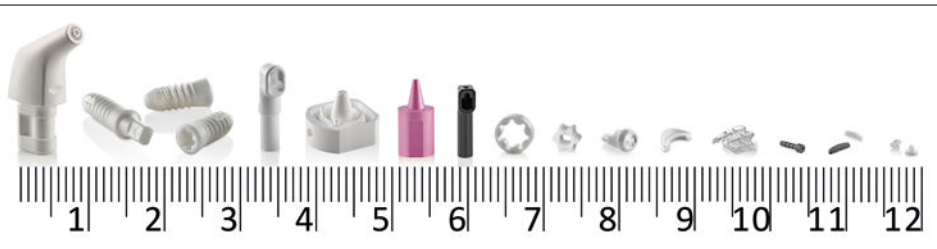


Fig. 1
Precision parts made of oxide ceramics: an innovative material for a wide range of industries

Technical fine ceramics have established themselves as an innovative material in many applications.

Alumina and zirconia in all their variations have been in use for many decades. However, the potentials arising from their use certainly still require explanation. So do the technical processes for shaping the material with the desired accuracy and surface finish. Ceramic Injection Moulding (CIM) represents another way of making the most of the advantages offered by these versatile materials.

However, to exploit this potential to the full, comprehensive know-how is required along the entire process chain, starting with material production and injection mould construction, through the actual CIM process, to post-processing and quality control. This is the only way to ensure product quality and reproducibility over many batches.

Applications for CIM components

The use of ceramics in existing or new products is particularly recommended for the following requirements:

- Biocompatibility
- Corrosion resistance
- Electrical insulation properties
- Wear resistance
- Surface finish (polished, net-shape under N_2 or R_a better than $0,05 \mu m$)
- Thermal stability
- High modulus of elasticity with low weight.

In the **medical technology** and **dental industry**, special emphasis is placed on biocompatibility, transparency, colouring, surface quality and reproducibility. This places high demands on the purity of the materials, process reliability and quality assurance. There is no shortage of applications in this industry, with dental implants, abutments, brackets, and tools for endoscopy and analysis.

In **mechanical engineering**, on the other hand, properties such as extreme hardness and wear resistance, corrosion and chemical resistance, and high mechanical strength with low specific weight are important.

Examples of applications in this field include nozzles, guides, gearwheels and threaded components.

The **electronics sector** places high demands on electrical and thermal insulation, ESD properties and geometric precision in the smallest component dimensions. Applications include bonding capillaries, glass fibre guides and grippers.

In general, it can be stated that ceramic injection moulding is an extremely economical and process-stable manufacturing method even for medium quantities >10 000/a with complex geometries, high tolerance requirements, thin walls or the smallest bores (Figs. 2–3).

Material characteristics

Apart from a variety of specific, application-related mixtures, two basic materials in particular have become established in the oxide ceramics sector:

Aluminium oxide (Al_2O_3) is currently the most important oxide ceramics material. It stands out by virtue of its:

- High strength and hardness
- High wear resistance
- Corrosion resistance
- High thermal conductivity (for ceramic material)
- Outstanding electrical insulation properties
- Resistant even at high temperatures.

Zirconium oxide (ZrO_2) is principally selected for the following reasons and characteristics:

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www.spt.net

Keywords
micro-CIM, precision injection moulding

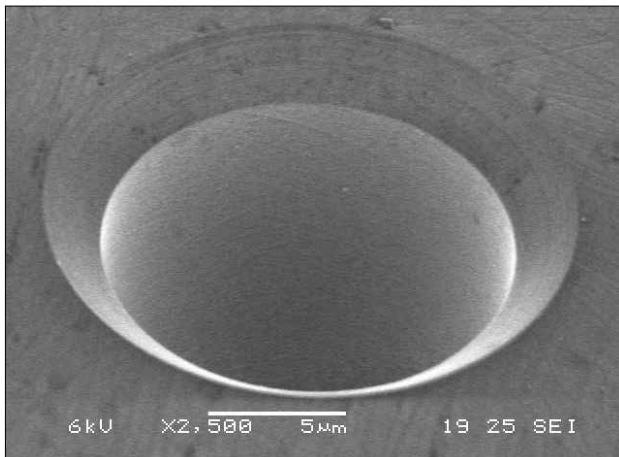


Fig. 2
Utmost precision for tiny components – nozzle bore in Al_2O_3 with diameter of 15 μm and tolerance of $\pm 1 \mu m$

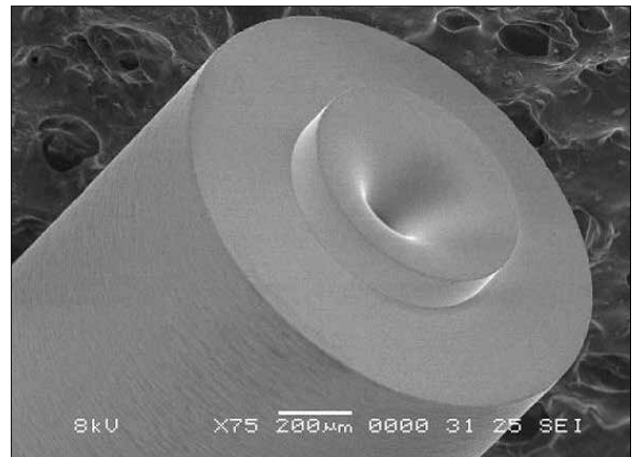


Fig. 3
Exceptional freedom of design for components in ZrO_2 ; manufactured without post-processing – finished sintered bore including outlet

- Exceptional bending strength
- High modulus of elasticity (comparable with steel)
- Low thermal conductivity
- Resistant even at high temperatures
- Good tribological characteristics.

The possibility of individually adapting and producing the material required for injection moulding, the so-called feedstock, with regard to mixing ratio, grain size and binding agent, creates the prerequisite for optimum design of the material properties to the requirements of the finished part.

Feedstock manufacturing

To meet continuously the highest quality requirements worldwide, SPT Roth in Lyss, Switzerland, manufactures the feedstocks required for injection moulding exclusively under precisely defined conditions in its

own production facilities. Since CIM, like any other shaping process for ceramics, is based on ceramic powder, the preparation of the starting material up to the processable feedstock is of paramount importance regarding subsequent process stability and component quality. Ceramic powders are subject to natural and production-related fluctuations in their quality and must be prepared in a certain way, but always reproducibly, before further processing.

The homogeneity of all starting materials and thus also of the feedstock is of elementary importance for the subsequent processes of spraying, debinding and sintering, because irregularities in the feedstock can no longer be compensated for by subsequent processes!

The correct preparation of the respective feedstock and the homologation (approval) of each powder batch according to the ISO

standard is directly decisive for the compliance and reproducibility of the tolerances as well as the achievement of the final density of the component.

Designing for CIM

To make optimum use of the advantages of CIM technology, the requirements of the ceramic materials and the CIM process itself must be considered in the component design. In this respect, close and cooperative coordination between the customer and the manufacturer of the component is highly recommended in the design phase to avoid problems due to design deficiencies. Therefore, already in the design phase of the component, the following points, among others, must be considered:

- Unnecessary and large differences in wall thickness as well as abrupt changes in cross-sections should be avoided.



Fig. 4
Transparent orthodontic bracket: finished injection moulded precision component



Fig. 5
Internal and external threads: no post-processing required

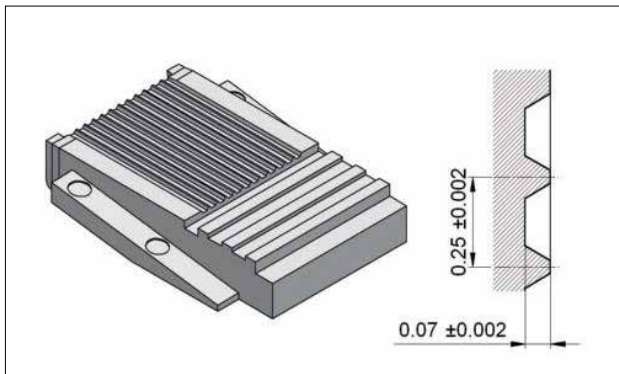


Fig. 6
Original component

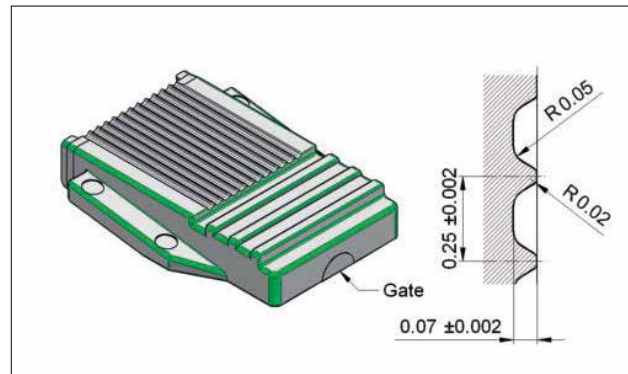


Fig. 7
The same component following redesign in accordance with CIM principles

- Accumulations of material should be circumvented (incorporate recesses).
- Wherever possible, round off sharp edges.
- Make lengthy, freestanding cores as symmetrical as possible.

Figs. 4–5 show two products with complex geometries that were injection moulded with all details and without any additional finishing process.

Figs. 6–7 show a component that was designed in a CIM-compatible manner together with the customer as early as the design phase.

Prototype parts for testing

To keep the cost and time expenditure low in the initial phase and still come into possession of initial samples, the production of prototype tools, so-called soft tools, is a possibility.

These are realised using the identical process as normal series tools. However, they are made of soft, easy-to-process quenched and tempered steel, which makes machining much easier. As a result, the customer receives the first sample parts – produced with the same material and process as later series parts – within four to six weeks for trials.

However, since the tool is made of limited wear-resistant material, only a few parts can be produced. If the customer finally decides to produce series parts after testing the initial samples, the soft tool must be replaced by a conventional tool suitable for series production.

The CIM process

Of all the shaping methods, the CIM process offers the most design freedom. In the CIM process, any geometries, for example internal and external threads, undercuts, oblique bores or free-form surfaces, can be generated directly without any post processing effort.

The oxide powder or powders are mixed with various binder proportions. The resulting feedstock must be capable of being injection moulded to a high green density, and the binder must be removable prior to sintering.

CIM is similar to plastic injection moulding and is performed on optimised micro injection moulding machines. An important point is that an optimum green density is achieved.

The binder components are usually carefully removed from the injection-moulded green compact via a temperature-time curve.

The binders are expelled by thermal decomposition or by a combination of extraction and pyrolysis. However, the debinded part must retain exactly the shape acquired in the injection moulding process. In sintering, compression takes place without pressure to almost theoretical density values of the pure material. Linear shrinkage of 20–30 % must be taken into account. Sintering of oxide ceramics is carried out in air or vacuum, with the sintering shrinkage depending on the material and the green density achieved during injection moulding. By means of Hot Isostatic Pressing (HIP), the microstructure can subsequently be compressed again (the last 0,5 %) under

heat and pressure for special applications. After thermal treatment, the parts have the properties of the pure material, such as hardness, density, compressive strength, stability, chemical resistance, warpage, thermal and electrical properties.

After the sintering process, the CIM blanks basically correspond to the finished part. If necessary, further processing can be used to remove e.g. the sprue or to produce a special product feature.

All common processing methods can be used for finishing operations, such as grinding, lapping, honing or polishing.

Summary

The shaping possibilities of the CIM process are comparable to those of plastic or metal Micro-Injection Moulding (MIM). As a result of the special properties of fine ceramics, however, completely new possibilities open up. Developments in recent years clearly show that more and more users from a wide range of industries have discovered and exploited these material and production technology possibilities for the further development of their products and are increasingly substituting conventional materials (plastic, metal) with fine ceramics.

These advantages manifest themselves – depending on the intended purpose of the substitution – in significant increases in component service life and/or in better service properties in terms of abrasion resistance, temperature resistance, biocompatibility, dimensional stability, aging resistance and generally increased wear- and corrosion-resistance.



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Design and Engineering with Hard Materials

The Institute for Materials Applications in Mechanical Applications/DE at RWTH University of Aachen (IWM) and the Institute of Applied Powder Metallurgy and Ceramics/DE at RWTH University of Aachen (IAPK) had extended an invitation to a colloquium that had been jointly organised by the institutes on 20.09.2022. In machine and plant engineering, hard materials are often associated with the negative characteristic of spontaneous brittle fracture. To enable the use of hard materials despite their low toughness and to utilise their excellent properties, a reliable lifetime prognosis is necessary. What calculation methods and what are the limitations of their application? Under the motto “Design and Engineering with Hard Materials”, at the IAPK Colloquium, papers on these topics from science and industry were presented. The spectrum ranged from classical structural ceramics and carbides to tool steels.

Papers

Prof. Dr-Ing. C. Broeckmann (IWM/IAPK), host of the event, was delighted to get Prof. Dr R. Danzer (Montanuniversität Leoben/AT) on board to present the keynote on **Engineering with Ceramics: Strength and Fracture Statistics**.

He began by exploring the different failure mechanisms of ceramics (brittle fracture, subcritical, slow crack growth, but also fatigue, creep and corrosion). Linear elastic fracture mechanics can be applied to describe the rapid expansion of cracks in brittle bodies. It should be taken into account, however, that inhomogeneous areas of stress exist. In the field, overload tests are often performed.

The factors influencing crack growth are multifaceted (stress intensity, water vapour pressure, temperature ...) – it precedes every brittle fracture. The defect with the highest stress intensity triggers it. The cause is often surface defects, but thermal cycling, too. In technical ceramics, over the years, the processes have become cleaner, which has led to more homogeneous and relatively small defects.

In the meantime, fracture-statistics-based design methods have been developed and are also applied successfully. Critically, the speaker remarked that there is a lack of “manual” routine to manage the specific challenges (like machining, handling, thermal cycling, edges, surfaces ...).

Dr-Ing. Atilim Eser (Ivoclar Vivadent AG/LI) spoke on **Lifetime Calculation of Dental Ceramics**. The Liechtenstein-based dental and medical engineering company Ivoclar registered strong growth in the business year 2021 with sales of over CHF 840 million, thanks to new products and further geographic expansion.

In product development, “in vitro” and “in vivo” simulation play a key role. That ranges from lifecycle prognosis for restorations on the basis of glass ceramics and zirconium oxide. Linear FEM is used efficiently for ZrO₂-based components. With SPT diagrams, it is possible to predict possibly clinical failure rates, and the stress levels to which crowns and dental bridges are exposed during their use.

The **Calculation and Design of a Ceramic Flat Sliding Valve for Hydraulics** was

explained by C. Liu (IWM). He came to the following conclusions. Laser-cut ceramic boards adapted to the geometry for flat sliders are not sufficiently fracture-resistant for hydraulic application. Component positions exposed to high stresses should be reworked. Cracks start at highly stressed positions on the Al₂O₃ slider and the Si₃N₄ control plate.

The calculated fracture probabilities are generally low. Laser structuring increases the bending strength of ceramics and reduces their strength scatter, the “economical” LS68 is a potential method for the future.

Dr-Ing. W. Beckert (Fraunhofer IKTS/DE) reported on the **Model-Based Design of Ceramic Components** and detailed the example of a ceramic spring. Here, precision surface machining has an enormous influence on the quality.

The **Numerical Design of High-Stressed Ceramic-Metal Composite Components** was explained by Dr-Ing. K. Sauerzapfe (Alumina Systems GmbH/DE). The solder geometry is modelled based on empirical values. Material characteristics for soldering metals



Figs. 1–2
 Impressions from the IAPK Colloquium 2022 “Design and Engineering with Hard Materials”

are simulated as “softer” than datasheet values/measured values for reduction of stress singularities. The metallization layer is not simulated. Fracture probability is used as a design parameter to compare parameter variations. Assessment of design solutions is only possible with comparable cross-linking. The absolute value of the calculated fracture probability cannot be transferred to a real component. Although the simulation results are flawed, it is possible to conduct a comparative assessment of different design variants and obtain an optimised initial geometry for prototype production.

Dipl.-Ing. Marc Neumann (IKFVW Freiberg University of Mining and Technology/DE) spoke on **Fracture Behaviour and Sub-critical Crack Growth in Flame-Sprayed Al_2O_3 Materials**. The structure of thermally sprayed ceramics exhibits pores and micro-

cracks on account of insufficient crosslinking and internal stresses. Moreover, during cooling, the freezing of metastable phases and amorphous areas can occur. All tested materials showed pronounced R-curve behaviour and medium-to-high susceptibility to sub-critical crack growth.

Dr T. Klünsner (Materials Center Leoben Forschung GmbH/AT) reported on **Factors Influencing Deformation and Fatigue of WC-Co Carbides**. For productive processes, the criterion “wear before fracture” must be met. Quantitative information on yield and fatigue is important as the yield behaviour influences the fracture behaviour! For carbides, phenomena from the world of both metals AND ceramics are relevant!

The **Influence of Thermally Supported Recompaction on the Strength of Addi-**

tive-Manufactured WC-Co Carbide was explained by S. Fries (IWM/IAPK). Defects from the PBF-LB process are eliminated in this way. With hot isostatic pressing and sinter-HIPing, the scatter of strength values and internal stresses can be reduced.

The **Component Design of High-Strength Tools Exposed to Multiaxis Cyclic Loading** was discussed by L. Scholl (IWM). Hardly any reliable, quantitative analyses of fatigue and mechanisms in high-carbide tool steels are available. In addition, no validated concepts for multiaxis component and tool design exist. Cold tools are often exposed to disproportionate multiaxis loads.

The next IWM/IAPK Colloquium will be held in Aachen, Germany, on 23 March 2023 and focus on “Sintering-Based Additive Manufacturing”. KS

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CERAMIC APPLICATIONS

Components for high performance

GERMANY/AUSTRIA

AM Ceramics 2022 Review

AM Ceramics 2022 (12–13 October 2022) was once again an inspiring and engaging two days packed full of thought-provoking talks from top ceramic industry experts. The successful return of in-person events, such as ceramitec and the AM Ceramics Shortcut Sessions held there, had built excitement for Lithoz's team over the entire year and the team was eager to welcome visitors back to the leading conference for ceramic 3D printing.

With the unique location of the Fraunhofer IKTS facilities in Dresden/DE and the motto "Let's Rewrite the Rules of Ceramics", this edition was a great opportunity for motivating discussion and networking with this top research institute in the ceramic field. Leading ceramic researchers travelled to Dresden to share their insights into the latest developments in ceramic 3D printing, as well as into their research work from industrial mass production through to medical and dental applications and multi-material printing.



Fig. 1
Prof. Dr Alexander Michaelis



Fig. 2
Dr Johannes Homa

Day 1

After a warm welcome from Prof. Dr Alexander Michaelis (Director of the Fraunhofer IKTS), Dr Johannes Homa (CEO Lithoz GmbH/AT) and Dr-Ing. Uwe Scheithauer

(Group Leader Additive and Hybrid Manufacturing at Fraunhofer IKTS) opened the event before day one began with an exclusive guided tour of the extensive Fraunhofer IKTS labs.

Participants had the chance to glimpse 10 different departments showcasing some of the world's most powerful ceramic 3D printing technology, with Fraunhofer IKTS giving insights into their Additive Manufacturing (AM) solutions for high-performance ceramics and presenting the workflows and processes they were to hear more about over the next few days.

The tour included stops to view shaping technologies, such as AM and injection moulding, as well as technologies for functionalization, such as systems integration and electronic packaging, microsystems, and smart materials and systems.

The final stop was all about the ceramic process chain, covering topics such as powder technologies, glass powder treatment, thermal treatment, and characterisation/scanning electron microscopy. After this tour, a series of exciting talks in the institute's main lecture hall kicked off AM Ceramics 2022.

Market innovation insights

Moderated by Dr Alexander Platzer (RHI Magnesita/AT), day one started with the

theme of market and innovation insights and industrial success stories.

Session 1 was opened by Dipl.-Ing. Andreas Berkau (IdeeKontor/DE) describing general trends in AM – in particular, those in metal and polymer AM that could also apply to ceramic AM from a service provider's viewpoint. Thanks to the conventional manufacturing processes for producing Technical Ceramic parts are currently far more complex, ceramic AM is a real opportunity for rapidly and cost-effectively producing end use parts and prototypes.

Dipl.-Ing. Edmar Allitsch (EOS Holding AG/DE) then shared insights from EOS into the requirements and customer expectations which come with scaling up ceramic AM from a prototyping technology to a full-scale process for industrial applications. While there are numerous opportunities in this growth stage, there are also significant challenges for this technology that have already been overcome by metal and polymer AM and which must be faced to establish AM as a key standard technology.

Dr Alexander Platzer gave a presentation on using AM for refractory ceramics. By developing 3D printed refractories, manufacturers can achieve such desirable milestones as becoming more energy efficient, reducing their CO₂ footprint and having stronger working regulations thanks to it being a more lightweight material. Passing around a 3D-printed refractory structure prototype, Platzer finishes by acknowledging the obstacles still faced by AM if this is to become a truly viable technology in refractories, including scalability, automated handling and whether raw materials are globally available and reasonably priced.

Stephan Seitz (CADdent/DE) then discussed the company's first experiences with Lithography-based Ceramic Manufacturing (LCM), as well as their reasons for choosing this technology and their current state of development. As a center with 15 years of experience in the AM of high precision dental products, CADdent shared its story on how they want to expand its range of services and become an expert in ceramic AM, choosing LCM technology as its partner and technological enabler in its journey.

Industrial success stories

Industrial success stories were the theme of session 2, with Peter Jain (3RD Axis/AU) explaining live from Australia how his company have successfully introduced and established ceramic 3D printing into traditional markets. While initially targeting dental and medical value chains, the forced shutdowns caused by COVID-19 presented an opportunity for the company to look towards low-cost, high-volume products for the consumer market. Using the CeraFab 7500 and CeraFab System S65 3D printers by Lithoz, the Australia-based team has successfully secured funding for two key research projects from the Australian governments.

Finally, Dr Malte Hartmann (Bosch Advanced Ceramics/DE) spoke of how AM has enabled Bosch to successfully produce powerful parts for industrial applications. AM has been positively viewed by Bosch as an advantageous technology from the start thanks to the level of geometrical freedom enabled when compared to other processes and the possibility for cost-effective, tool-free prototyping.



Fig. 3

Dr.-Ing. Uwe Scheithauer during the guided tour

BASF/DE, a prestigious company in the chemical industry, produced an exceptionally complex microreactor for high temperature reactions together with the Karlsruhe Institute of Technology/DE. Aluminium oxide was used for this component thanks to its high thermal conductivity and low thermal expansion, while AM allowed for the complex inner structures needed for effective use.

Day 1 ended with the traditionally atmospheric dinner at the beautiful Carola-schlösschen Dresden, which offered the chance for participants to talk, catch up and network in comfortable setting before the exciting talks resumed the next morning.

Day 2

Medical and dental insights

The second day of AM Ceramics was kicked off by a session on medical and dental in-



Figs. 4–5
Impressions from the guided tour



Fig. 6
Group photo of the participants at AM Ceramics 2022 in Dresden

sights. Adrián Martínez Cendrero (University of Madrid/ES) gave a presentation about multi-material AM for articular tissue engineering as part of the INKplant EU project, examining the goals and initial results as well as current challenges and research trends for the future. The complex geometries enabled by AM is just one of the reasons it is a preferable technology to more traditional manufacturing processes.

Priv.-Doz. Dr Sebastian Schwindling (Heidelberg University Hospital/DE) then focused on dental applications in ceramic 3D printing. In his comprehensive presentation he looked at the obstacles and trends of today alongside the possibilities of 3D printing replacing traditional methods to manufacture dental restorations in the future. Additive technology enables less material waste, less tooling stress and more geometrical freedom than current conventional workflows.

Prof. Dr Dr Frank Tavassol (Hannover Medical School/DE) spoke about how using individually printed 3D constructs may soon reduce the risk of donor site morbidity. By using artificial ceramic bone replacement materials such as tricalcium phosphate, patient-specific 3D-printed implants can be produced which show good biocompatibility and which are more cost-efficient and with far less risk of complications.

To round off the medical and dental session, Prof. Dr Franz E. Weber (University Zurich/CH) gave a stimulating lecture on ceramic bone substitutes. With further research being made into optimal microarchitectures of bone replacements, the various factors which make implants comparable to natural bone were discussed.

Exciting new technologies

The next session – all about exciting new technologies with a particular focus on multi-material 3D printing – began with Dipl.-Ing. (FH) Murat Demirtas (FGK Forschungsinstitut für Glas – Keramik GmbH/DE) sharing the latest developments in ceramic multi-material printing. Thanks to AM, previously unachievable forms of ceramic composites have been unlocked and this presentation focused on the current research cooperation between Lithoz and FGK – in particular, in terms of the multi-material vat photopolymerization of alumina and zirconia.

Prof. Dr Serkan Nohut (Piri Reis University/TR) gave a lecture on the lithography-based AM of multi-material ceramic components. As technology has progressed, AM can now be used to create flexible combinations of ceramic-ceramic and ceramic-metal in a single part, allowing for customized design with improved functionalities. Recent

developments in multi-material 3D printing via LCM now allow for simultaneous processing of two photocurable suspensions with high dimensional precision in a cost-effective manner, with the challenges and future opportunities being explained during Nohut's talk.

Continuing with the session, Dr Johannes Homa spontaneously substituted Dr Thomas Mühler (QEP3D/DE) to speak about how 3D printing technologies have the power to completely revolutionise any company's workflow, explaining how a service provider can successfully offer a tailor-made ceramic 3D printing solution and integrate ceramic materials and technology along the entire production process. Two new and innovative ceramic 3D printing technologies, LIS and LSD, were presented and compared, explaining each processes' strengths and main features in detail.

To round off this section, Dr-Ing. Uwe Scheithauer discussed the hybrid manufacturing of multi-functional and multi-material ceramic components, sharing his insights into how a combination of different AM technologies can help overcome the limitations of these individual processes by producing single parts of a component separately using various AM techniques and putting this together in the final processing stage.

However, this greatly limits the geometric freedom in designing a part compared to manufacturing the component simultaneously, but currently allows for a larger choice in material combinations. Research into the status of hybrid manufacturing of multi-functional and multi-material ceramic components was presented here, along with the potential of different approaches.

Material research findings

The final session of this year's AM Ceramics was all about material research findings. Dr Andraž Kocjan (Jožef Stefan Institute/SL) gave a talk on the rapid sintering of 3D-printed ceramics with controlled microstructures, explaining how the typical "slow" sintering processing step of advanced ceramic production limits the complexity and scale of microstructures able to be produced.

By using a faster sintering technique, such as fast firing, uncontrolled grain growth may be prevented to produce tailored

microstructures with the intricate geometrical complexity enabled by AM.

Dr Jochen Schilm (Fraunhofer Institute for Ceramic Technologies and Systems IKTS) then focused on the near-net-shape manufacturing of glasses for a wide range of applications, explaining how Fraunhofer IKTS has been investigating various manufacturing processes, such as conventional powder-technological manufacturing routes and additive processes, to produce complex and functional glass components. This presentation shared a look into the technical possibilities of manufacturing such individualised parts for large-scale production, as well as the range of applications for such parts.

Finally, Ass. Prof. Dr Tanja Lube (Montanuniversität Leoben/AT) rounded off the entire event with her insightful results of a strength test on ceramic AM components. Due to various aspects of the manufacturing technique, the strength of a 3D-printed ceramic part may depend on the orientation

in which stresses act with regard to build direction. The CharAM project allows for the manufacture of a test body for statistical evaluation of the LCM printing process, with the results of strength, strength-build direction relationship and the practical aspects of this production method being presented. With all the talks concluded, there was a final farewell to the participants, rounding off another inspiring year of talks and discussion at AM Ceramics 2022. Thanks to the varied range of expert speakers from different ceramic fields, the professional hosting of the Fraunhofer IKTS institute and eager networking between visitors, the 2022 event was a success with great feedback from all sides.

The next AM Ceramics will take place in 27–28 September 2023 in the beautiful city of Vienna/AT. If you are interested in taking part, please get in contact so the Lithoz team can keep you updated.

Publication Schedule 2023

Central Themes	Additional Circulation / Presence at Following Events	Issue	Editorial Deadline	Advertising Deadline	Publication Date
energy and environmental technology mechanical and chemical process engineering bioceramic components and medical devices electronics and sensors wear and corrosion protection high-temperature applications electronic and magnetic components coatings additive manufacturing, CIM, metal industry, optics, mobility	IDS, Cologne/DE; 14.-17.03.2023	Newsletter HOT TOPICS Including Special Hannover Messe / Special Ceramics Expo			April 23
	Hannover Messe, Hanover/DE; 17.-21.04.2023				
	Ceramics Expo, Novi, Michigan/US; 01-03.05.2023	2/2023	05.04.23	05.05.23	01.06.23
	EPHJ-EPMT-SMT, Geneva/CH; 06-09.06.2023	Newsletter HOT TOPICS Including Special Thermprocess			June 23
	GIFA-METEC-THERMPROCESS-NEWCAST, Dusseldorf/DE; 12.-16.06.2023				
	The Advanced Ceramics Show, Birmingham/GB; 28.-29.06.2023	3/2023	18.08.23	20.09.23	20.10.23
	AM Ceramics, Vienna/AT; 27.-28.09.2023	Newsletter HOT TOPICS Including Special formnext			November 23
	EURO PM2023, Lisbon/PT; 02.-04.10.2023				
	Ceramics Japan, Tokyo/JP; 04.-06.10.2023				
	formnext, Frankfurt/DE; 07.-10.11.2023				

Subject to change!

Multi Material 3D Printer from AMAREA Technology GmbH – the New Spin-off of Fraunhofer IKTS

AMAREA Technology GmbH, the new spin-off of Fraunhofer IKTS/DE, is a systems supplier of multi material 3D printers that allow multiple materials such as ceramics, metals, polymers and composites to be combined in a single built to produce innovative functionalised components that could not be produced using prior manufacturing technologies.



Fig. 1
Silicon nitride – molybdenum disilicide: one material combination, many possibilities: ceramic igniter (l.) and heating element (r.) shown as CAD – rendering – sintered component

Until now, there have been only a few commercially available 3D printers that are capable of processing two materials in one step. However, these 3D printers are limited in terms of the materials that can be printed, or there is a lack of industry-relevant, co-sinterable material combinations. In addition to a flexible 3D printing technology optimized for multi materials, the materials that can be processed and the know-how to adapt different materials to each other are essential in order to achieve co-sintering capability.

For this reason, the development of the Multi Material Jetting (MMJ) technology has been driven forward at Fraunhofer IKTS for a decade. Prior to the founding of AMAREA Technology, the founders already took decisive steps towards the commercialisation of the technology including the extensive material portfolio within the EXIST Research Transfer Program (03EFQSN180) of the German Federal Ministry of Economics and Climate BMWK.

As a systems supplier, the Fraunhofer IKTS spin-off AMAREA Technology develops and distributes industrial 3D printers and materials starting in 2023. With its state-of-the-art 3D printers,

AMAREA Technology addresses manufacturers of components made of high-performance materials, who are looking to start 3D printing of multi material components in order to secure a decisive competitive edge.

The ability to manufacture assemblies in one printing process presents new opportunities in the design process and production of innovative smart products. MMJ technology makes it possible to produce different properties such as electrically conductive and electrically insulating, dense and porous, magnetic and non-magnetic or hard and tough combined with better tribological properties across material classes within a single component. This can decisively upgrade the performance of products and thus the benefits for the end user. By shortening the process chain from sequential to direct manufacturing, not only production times but also costs are reduced.

Technology

The MMJ technology developed by the four founders at Fraunhofer IKTS is based on a dropwise layer-by-layer building process. Molten particle-filled thermoplastic materials are selectively deposited as individual droplets and fused together directly during deposition. The individual droplets can be parameterized to a high degree and their characteristics such as droplet diameter, droplet height or droplet volume can be varied.

Due to the wide range of parameters, diameters from 200 µm to over 1000 µm and layer heights from 80–500 µm can currently be realised. In this way, adjusting the droplet characteristics to part geometry enables the creation of both small, precise droplets (around 0,5 nl) for fine structures and larger droplets (over 80 times larger) for fast production of large-volume structures. By using three or more print heads, different materials can be combined to provide the material properties required according to the performance criteria of the component's application. Multi material components with integrated functions are produced with MMJ without interruption in a single built, i.e. the technology is free of time-consuming, manual and therefore cost-intensive labour, such as retooling or cleaning

Recent Trends of Advanced Ceramics Industry and Fine Ceramics Roadmap 2050

Japan's fine ceramics (advanced ceramics) industry, which reached USB 30 billion of production in 2018 (an annual growth rate of 6,3 %), accounts for 40 % of the global market. The mission of the Japan Fine Ceramics Association (JFCA), which consists of 116 corporate members related to fine ceramics, is to further promote the development of this industry. The latest JFCA's activities, include the publication of the FC Roadmap 2050 (2021 edition). This roadmap addresses fine ceramics technologies and products that will meet increasingly diverse needs of society, market, and industry in the year 2050.

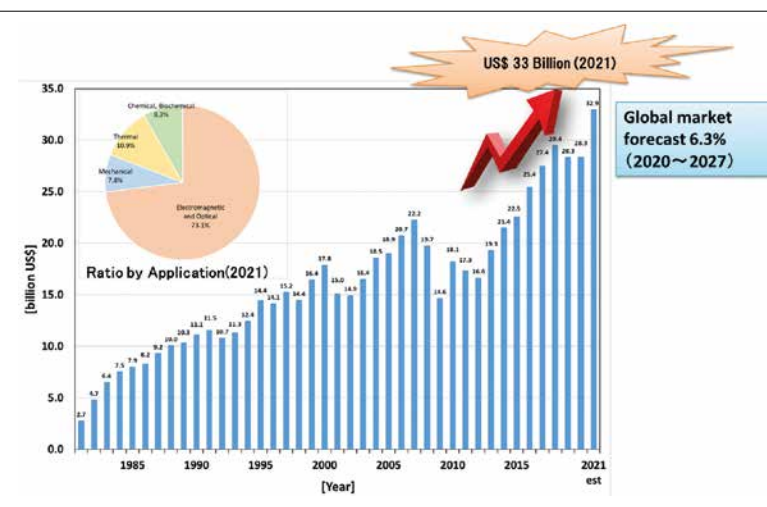


Fig. 1
Fine Ceramics Production in Japan

JFCA introduction

JFCA researches the trends in the fine ceramics industry in Japan and publishes a market trend survey report every year. JFCA is the co-organiser of Japan Ceramics Expo that is one of the world's largest exhibitions alongside ceramtec in Munich/DE and Ceramics Expo in Novi/US. Japan Ceramics Expo gathers all kinds of highly functional ceramics and related materials as well as a wide variety of equipment for forming/processing, burning/heating, evaluation/testing/analysis, and so on. It is held every year in Osaka and Tokyo. JFCA published FC Roadmap 2050 (1st edition) in 2016 as a commemorative project for its 30th anniversary. Periods of 5 years have

passed, and the market situation has changed significantly, which is shown in FC Roadmap 2050 (2021 edition).

Recent trends of advanced ceramics industry

Fig. 1 shows the production trends of fine ceramic products in Japan. These data are the latest surveyed in 2021. Japan's fine ceramics industry has been growing very significantly in recent years since 2013. The total domestic production in 2021 is expected to reach a record high of billion. The production of electromagnetic and optical components accounts for 73 % of the total. The main factors of the strong growth were the strong demand for smartphones, automobiles, and other information and communications applications. Although global production of automobiles and smartphones fell far short of the previous year's level due to the impact of COVID-19, fine ceramics output increased due to higher demand for semiconductors used in equipment, such as PCs and memory devices. In addition, sales of heat- and semiconductor-related materials increased due to increased capital investment in semiconductor manufacturing equipment.

Fig. 2 shows the global share of the production of the fine ceramics industry. The world market is about USD 70 billion in 2018. Japan has a global production share of about 40 %, and USA does about 30 %. Fig. 3 shows the latest global sales market forecasts. In the global sales market, China and the United States have large shares. An average annual growth of 6,3 % is expected from 2020 to 2027. Fig. 2 shows the production share, whereas Fig. 3 shows the sales market share. Japan's production share is about 40 % of the global production, whereas its sales market share is about 8 %. Many fine ceramics products produced in Japan are exported overseas (mainly to USA and China).

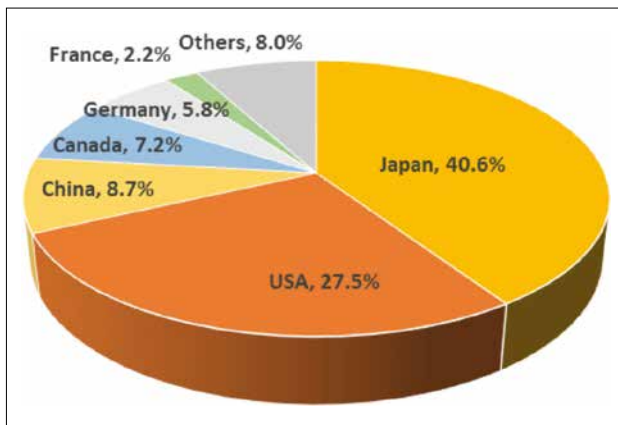


Fig. 2
Fine ceramic industry's share of global production

JFCA R&D

Reliability assessment methodology for advanced CMCs

CMCs are currently considered to be applied much more for aero-engine components to improve fuel efficiency and to reduce overall CO₂ emissions. The more applied, the greater the need for the evaluation of their properties. The project members will establish multiple criteria decision analysis to innovate on the current situation where results of a single NDE (nondestructive evaluation) method only cannot provide total performance and properties of CMCs.

Promise of Tiny Integrated Laser (TILA)

This project is the development of high-power lasers. In this research, we aim at a THz (terahertz) wave solid-state laser with higher output and higher brightness than a free electron laser in the THz wave region, which is the ultimate wavelength of solid-state lasers. During the last 5 years of work, JFCA carried out "giant micro photonics" research and manufacturing process development on new transparent ceramic materials, their surface treatments, and bonding, and finally developed a power-scalable and practical extremely high-power density laser. At the same time, the aim is to create the world's highest output and high brightness THz wave solid-state laser by performing wavelength conversion to the long wavelength limit. We also aim to socially disseminate usefulness and effectiveness of high-power, high-density compact power lasers for their new applications.

Foundation construction of process informatics for fine ceramics

This project is for building foundation of process informatics for fine ceramics. In the manufacturing process of fine ceramic components, such as electronic ones, which have a high global market share, complicated physical, and chemical changes proceed. Product characteristics, such as performance, reliability, and durability, are determined by the microstructure resulting from the transformation.

To create innovative manufacturing technology, it is necessary to design a real-scale digital process using "integrated process simulation technology" based on an understanding of process phenomena and microstructure formation mechanism. The aim is to develop

process simulation technology that can be used for manufacturing fine ceramics and verification of numerical experimental data by computational science. These efforts will accelerate the design of innovative processes that will lead to the creation of the next-generation fine ceramic materials.

FC Roadmap 2050 (edition 2021)

FC Roadmap 2050 consists of two parts: the Roadmap and the International Survey. The roadmap comprises the following nine fields of the six "primary fields" and the three "crosscutting fields".

- Primary fields: (1) transportation and mobility, (2) telecommunications, (3) medical care and welfare, (4) energy, (5) infrastructure, and (6) environment
- Crosscutting fields: (1) sensor, (2) battery, and (c) semiconductor materials and devices

The roadmap structure consists of three levels: market roadmap, product roadmap, and technology roadmap. Market roadmaps have overall trends, market needs, and market size. Product roadmaps have expected functions and products. Technology roadmaps have required technologies of ceramic-related materials and products. Although FC Roadmap 2050 aimed principally to show the public the future society realised by a variety of developed ceramic-related technologies, it also placed a special focus on identifying specific technologies required for expected products/systems as in detail as possible, to help researchers and engineers identify midterm and long-term needs of society and market. This roadmap should be of some use for those involved with the strategic planning of ceramic-related future R&Ds.

As a part of the investigation for FC Roadmap 2050, a survey for opinions of researchers, engineers, technologists, industrialists, and others worldwide who are related to ceramic technologies, concerning future visions on fine ceramics was conducted. The purpose was to investigate their thoughts on technologies and products of fine ceramics that meet diversifying needs of society, market, and industry in the year 2050 and the potential approaches to attain the needs, and to identify what kinds of technological developments one need to do during the coming 30 years. The participants in this survey include the JFCA member companies as well as foreign companies and researchers whom JFCA has been acquainted with through their international activities, and so on.

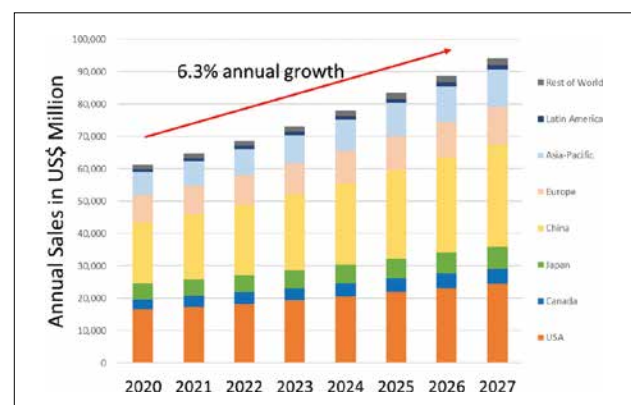


Fig. 3
Global sales market share and perspective of annual sales

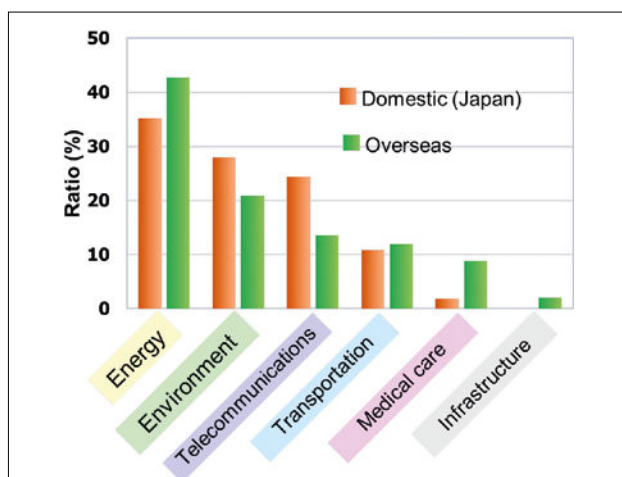


Fig. 4
Major application fields selected by Japanese and overseas respondents

FC Roadmap 2050 opinion survey

JFCA conducted a survey for opinions of researchers and engineers worldwide on future visions of advanced ceramics over the coming three decades.

Some of the most representative questions we asked include the following:

1. Major application fields that will be influential to ceramic industry?
2. Key technologies needed for future development of advanced ceramics?
3. Major innovations in advanced ceramics in the coming three decades?
4. Driving force needed for future development of ceramic industry?

38 responses domestically and 64 from overseas were analysed.

Tab. 1
Key technologies selected by Japanese respondents (Top 10)

Ranking	Key Technologies
1	Electrode materials for rapid and high current charge and discharge
2	Solid oxide electrolytic cell materials for hydrogen production
3	Adsorption and membrane materials for broad use of carbon dioxide removal devices
4	Material informatics for creating new materials used in ceramic electro-devices
5	Nanomaterials technologies for miniaturisation of ceramic electro-devices
6	Multilayers technologies for larger capacity
7	Cost-effective electrode materials
8	Insulating heat dissipation substrate for power semiconductor devices
9	Fuels for renewable energy
10	Wide-bandgap semiconductor materials for large diameter wafer used in power electronic devices

Major application fields that will be influential to ceramic industry?

Fig. 4 shows the ratios of the major application fields Japanese and overseas respondents selected as those which would be most influential to fine ceramics industry over the coming three decades. Both the fields of Energy and Environment draw a lot of attention, and particularly, the climate action in the energy field is expected to spur new technological innovations and new industry developments accompanied with bountiful job creation.

Ceramics draw a lot of expectations, as they can significantly contribute to various products and technologies in these two fields, including environmental purification filters and photocatalysis, for environmental issues and SOFC, power storage technologies (lithium-ion batteries, etc.), renewable energies (solar light, solar heat, winds, geothermal, etc.), high-efficiency power conversion, high-efficiency gas turbines, and so on for energy.

Key technologies needed for future development?

Tabs. 1–2 show the rankings of the key technologies (Top 10) the Japanese and overseas respondents selected, respectively, as those which would be necessary for the development of ceramics over the coming three decades. The following four technologies appear among the Top 10 in both the tables:

- Electrode materials for rapid and high current charge and discharge
- Solid oxide electrolytic cell materials for hydrogen production
- Adsorption and membrane materials for broad use of carbon dioxide removal devices
- Fuels for renewable energy

As stated earlier, the global warming problem is the most serious common concern, and the technologies conducive to solving this problem attract a lot of attention. Although many of the other technologies highly ranked by Japanese respondents are related to electronics and semiconductors, the overseas respondents include 3D printing of medical materials, CMC materials for aircraft engines,

Tab. 2
Key technologies selected by overseas respondents (Top 10)

Ranking	Key Technologies
1	3D printing technologies for manufacturing medical materials in bio-use
2	CMC materials for a lighter airplane with high propulsion efficiency
3	Electrode materials for rapid and high current charge and discharge
4	Environment-friendly battery materials
5	Adsorption and membrane materials for broad use of carbon dioxide removal devices
6	Implantable sensors
7	Fuels for renewable energy
8	Solid oxide electrolytic cell materials for hydrogen production
9	Sensors for fault and defect detection in infrastructures
10	Flexible and expandable perovskite-type solar cell materials

Tab. 3
Major innovations in the coming three decades

Category	Major Innovations
Application	H ₂ energy cycle, CO ₂ separation, water purification, electronic, communication, transportation, medical, and so on
New materials	Materials search via. MI/AI, polymer-integrated ceramics, self-crack-healed ceramics, and so on
Property improvement	Multi-functionality, harsh environment resistance, new properties of ceramic/non-ceramic composites, and so on
Structure control	Atomic-level control, precise surface/interface control, integrating dissimilar phases, critical defect control, and so on
Processing	Sensor/monitor-controlled manufacturing, zero-waste production, recycling/reusing, MI/AI-incorporated, advanced 3D printing, and so on
Analysis/evaluation	Advanced modeling/simulation, better prediction via. MI/AI, visualisation/monitoring of process, and so on

implantable sensor materials, and structural materials, indicating their strong concerns in the fields of medical care, aerospace, defense, and so on.

Major innovations in the coming three decades?

Tab. 3 shows what the respondents considered to emerge as the major innovations in fine ceramics over the coming three decades. The responses were classified into the six categories. For example, the major innovations in Application which are expected commonly by both the domestic and overseas respondents include ceramic technologies conducive to solving the global problems of energy, environment, and so on, which our human society is now facing. Those are typically related to high-performance batteries, energy transfer, storage, renewable energy, carbon dioxide separation, hydrogen energy cycle, water and environment purification, environmental load reduction, and so on.

Driving force needed for future development of ceramic industry?

Tab. 4 shows what kind of driving force the respondents considered to be necessary for the future development of fine ceramics industry. The responses were classified into the three categories of “society/research system”, “human resource development”, and “research/technical issues”. The typical remarks both from the domestic and overseas participants about “society/research system” category are “more integration and collaboration among universities, government agencies, and industry”, “effective industry-academia-government projects which would benefit all”, “government initiatives and supports for R&Ds”, “global interaction, collaboration, and partnerships on key technologies that would solve critical problems on the earth”, “more interdisciplinary efforts on critical global

Tab. 4
Driving force for the future development of fine ceramics industry

Category	Driving Force
Society/ research system	• Effective industry-academia-government collaboration • Government initiatives and supports • Global interaction and partnerships on world-level issues
Human resource development	• Nurturing next-generation for future ceramics • Nurturing young researchers having strong motivation of R&D • Need more investment for education
Research/ technical issues	• Interdisciplinary research for optimizing potential • Integration technology for multi-functionality • More fundamental research • Persistent efforts for elucidation on structure–property relationship

issues”, “technological innovation for energy and environment issues”, and “comprehensive technological development strategy of advanced ceramics”.

Summary

Japan’s fine ceramics industry has a production output of over USD 30 billion and continues to grow at an annual rate of 6.3 %. The global market is growing at a similar rate. Society is rapidly changing due to a lot of unpredictable affairs, and individual values and work styles are diversifying, requiring evolution toward a new society.

Going forward, it is expected to further strengthen our technological capabilities, particularly in fine ceramics, through the development of more advanced materials and the innovation in manufacturing processes. JFCA intends to further leverage our strengths together with overseas ceramics family to contribute to the advancement and development of human society and market expansion more than ever before.

Remark from the editor:

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 Fax: +49 (0) 241 16003 29
 E-mail: vanloo@alpha-ceramics.de

Homepage:

www.laeis.eu/alpha-ceramics

Ceramic division(s):

Technical Ceramics, Refractories, Tool Production

Turnover total:

EUR 1,2 million

Ownership:

100 % subsidiary of LAEIS GmbH

Number of employees:

total: 10

in R+D: 2

Production programme:**Material:**

alumina high purity, ceramic oxide powders, cordierite, corundum, high purity alumina porous ceramics, mullite, spinel, zirconia

User industry:

armour, brazing, cutting tools, dental technology, electronics and sensors, food and beverage, furnace and kiln manufacturer, kiln furniture, R&D (universities/institutes/corporate), refractories, technical ceramics, vacuum technology

Production plant:

casting, dry pressing, powder processing, sintering, uniaxial pressing, vacuum forming production

Special know-how:

uni-axial dry-pressing under vacuum conditions, production of cordierite, mullite/corundum-based and oxid-ceramic (Al_2O_3 , MgO , ZrO_2 -Ca) kiln furniture, tool production (spray-drying, pressing, firing), R&D

Part of the technology group**CERAMIC APPLICATIONS****Company name / Address details:****ALUMINA SYSTEMS GmbH**

(formerly LAPP Insulators Alumina GmbH)

Bahnhofstr. 43, 96257 Redwitz, Germany
 Tel.: +49 (0) 9574 65432 250
 Fax: +49 (0) 9574 65432 617
 E-mail: info@alumina.systems

Homepage: alumina.systems/**Turnover total:** EUR 14 million**Ceramic division(s):** 2**Ownership:** Management and Advisory Board**Management:** Dr.-Ing. Holger Wampers**Number of employees:** total: 104; in R+D: 8**Production programme:**

Material: alumina, copper, iron-nickel alloys, tungsten carbide

User industry: accelerators, electronics and sensors, energy technology/power generation, laser technology, mechanical and chemical process engineering, medical technology, plasma treatment, semiconductor industry, vacuum technology

Main components: ceramic-to-metal-integrated systems, metallized ceramics, ceramic thyristor and diode housings, feedthroughs, ceramic vacuum components, ceramic 3D-printed parts, ceramic batteries

Production plant: after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, casting, CIP, dry pressing, metallizing, unfired machining, vacuum brazing

Market leadership: ceramic housings for thyristors and diodes, ceramic-to-metal-joined systems, metallization of ceramics, galvanic gold and nickel plating

TOP-Innovator 2017, prize TOP 100

Best Component Award Technical Ceramics 2018: 1st Place

TOP-Innovator 2019, prize TOP 100

Innovation Leben Award 2020

Special know-how: 3D-printing components made of Al_2O_3 (99,99 %); CAD engineering techniques by using FEM; 3D-printing of ceramic parts; FEA-added product development and design optimization for ceramic and ceramic-to-metal-joined systems

Certificates: DIN 9001/ DIN 140001/ DIN 500001 Best Component Award Technical Ceramics 2018: 1st Place ISO 9001:2015, ISO 14001:2015, OHRIS

Product development partnerships: customers, institutes, user industries, suppliers

Project funding: industry

Pilot run series: yes

Project duration: 2 months

Fair:

ceramitec, Munich/DE
 formnext, Frankfurt/DE

Part of the technology group**CERAMIC APPLICATIONS****Company profile:**

Roots of **ALUMINA SYSTEMS** go back to the Siemens ceramic plant founded 1942 in Redwitz. ALUMINA SYSTEMS is producing ca. 400 000 p. a. ceramic-to-metal-joined integrated systems e.g. for thyristors (HVDC – High-Voltage Direct Current transmission), vacuum interruptors and X-ray systems, using primarily aluminum oxide ceramics and various non-ferrous metals, such as OF Cu (Oxygen-Free copper) or NiCo (nickel-cobalt), soft magnetic alloys; NiFe (nickel iron) or stainless steel (1.4301), as connecting agents. As a material connecting technology, both passive and active brazing technique are used. With this, high-strength composites can be produced. They are permanently proof and vacuum-tight in the temperature range from $-150\text{ }^{\circ}\text{C}$ up to $+600\text{ }^{\circ}\text{C}$. The core competencies in connection technology „Metal-ceramic composite“ enables ALUMINA SYSTEMS to open up other fields of applications. These are products such as vacuum feedthroughs (standard program), systems for CO₂ lasers and ceramic batteries. Further experience exist in the bonding and shrinking of metal ceramic composites. ALUMINA SYSTEMS stands as technology partner in the range of the metal-ceramic adding technology for electrical applications in: • Vacuum Systems • Space Systems • Laser Systems • Sensor Systems • Mechanical Systems • Energy Systems (including HVDC Systems and Battery Systems) • 3D Systems - 3D printed ceramic components • X-ray Systems • Plasma Systems • Oil-Gas Systems • Chip Systems • FEA-added Product Development (FEA: Finite Element Analysis). From single prototypes to serial production, we offer our customers the full range of customized solutions made by a innovative mid-sized company.

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html

**Company name / Address details:****Bakony Technical Ceramics Ltd.**

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 Fax: +36 (0) 88 4217 15
 E-mail: info@bakonycer.hu

Homepage: www.bakonycer.hu

Ceramic division(s): Advanced Technical Ceramics Producer

Management:

Ferenc Kurucsai, Managing Director

Number of employees:

total: 200

Company profile:

Bakony Technical Ceramics Ltd. with its almost 50 years' manufacturing experience is an influencer among the technical ceramics production companies in Europe. Our 200 colleagues at our Veszprém headquarter produce annually ca. 60 million high alumina ceramics, sold in 20 countries all over the world. Our main markets are located in Europe, USA and the Far-East. Our excellent quality products provide a complex, innovative solution for the followings industries:

- domestic and industrial devices: spark plugs for gas appliances, ignition and ionization electrodes, grinder discs and valves, sensor parts, ceramic lamp parts;
- welding industry: ceramic beads and insulation sleeves;
- paper industry: dewatering assemblies and hydrofoil blades;
- medical equipments: various ceramic components (compressor inserts, endoscope ends, scalpel inserts, etc.);
- automotive industry: heating element holders agriculture: ceramic ruminal boluses, nozzles;
- pumping technology: pistons, plungers, shafts, bearings, sealing rings.

Furthermore, our advantage is that we produce granulates for dry- and isostatic pressing forming technologies as raw materials and for sale as well. All our process have been ISO 9001 certified since 1995. The constant control during manufacturing and special instruments for measuring various characteristics of our products are the guarantee for good quality and customer satisfaction.

Production programme:**Material:**

alumina high purity, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ) high purity; alumina, spray dried; zirconia; zirconia toughened alumina/alumina toughened zirconia ZTA/ATZ

User industry:

armour, CIM, electrical and thermal insulation, electrical engineering, energy technology/power generation, fluid handling technology, food and beverage, high temperature applications, medical technology, OEM, oil and gas, technical ceramics, vacuum technology

Production plant:

3D measuring, assembling, CIM, debinding, dry pressing, extrusion, finishing, glazing, grinding, grinding cut-to-size, hard machining, isostatic pressing, lapping, polishing, powder processing, pressing, sintering, white and green body processing

Market leadership:

ceramic beads insulation sleeves for welding applications; ceramic insulators for gas appliances; ceramic boluses for rfid systems; ceramic shafts bearings sealing rings; various ceramic components

Special know-how:

product and process development; tool design and realization; prototyping; material selection/development; different technologies (isostatic-pressing, dry-pressing, high-pressure injection molding (CIM), 3D-milling, extrusion); sintering; pre- and post-machining (cutting, boring, drilling, milling, grinding, polishing etc.); high precision machining (hole-, centerless- and parallel grinding, lapping, polishing); glazing; assembly; quality control; packaging; global delivery

Certificates:

ISO 9001/2015; WRAS; KTW

Product development partnerships: customers, institutes, user industries, multidisciplinary

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****Bangerter Microtechnik AG**

Mühlaudamm 2 / P.O. Box 125, 3270 Aarberg, Switzerland
 Tel.: +41 (0) 32 391 25555
 E-mail: marc.bangerter@bangerter.com

Homepage: www.bangerter.com

Number of employees:

total: 130
 in R+D: 20

Company profile:

Bangerter manufactures components for many different industries: from mechanical engineering and tool making to textile and semiconductor technology to the automotive and aviation industries. Due to the bio-compatibility and high wear resistance, ceramics are ideal materials for many applications in medical technology. Bangerter supplies the most reputable watchmakers of the world with precision components made of ceramics for cases and other integral parts.

Production programme:**Material:**

alumina, alumina and platelet reinforced zirconia, alumina high purity, cermet, coloured zirconia, direct-sintered silicon carbide, high purity alumina porous ceramics, piezoceramic components, silicon carbide, silicon nitride, tetragonal stabilized zirconia, titanium carbide, tungsten carbide, yttria-stabilized zirconia suspensions, zircon, zirconia, zirconia and platelet reinforced alumina, zirconia HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

automotive, dental technology, electrical and thermal insulation, electrical engineering, fluid handling technology, high temperature applications, mechanical and chemical process engineering, medical technology, metal industry, oil and gas, optics, semiconductor industry, technical ceramics, textile, watch industries

Production plant:

3D measuring, assembling, bonding, coating, finishing, grinding, hard machining, HIP, lapping, laser machining, polishing, sintering, ultrasonic assisted machining, unfired machining, white and green body processing

Part of the technology group

CERAMIC APPLICATIONS

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**Company name / Address details:**

BCE Special Ceramics GmbH
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Fax: +49 (0) 621 479296
E-mail: info@bce-special-ceramics.de

Homepage: www.bce-special-ceramics.de

Turnover: EUR 4,0 million

Ownership: private

Management: Franziska Bertsch-Würfl, Dr Torsten Weiß

Number of employees: total: 28; in R+D: 2

Company profile:

BCE founded in 1986, manufactures customized mainly oxide ceramic components made out of alumina (Al_2O_3), zirconia (ZrO_2) and mixed oxides ATZ or ZTA as well as steatite or cordierite materials starting with lot sizes from one part (prototypes) up to (small) series production. With restriction to component geometries also nitride and carbide qualities are available. Based on more than 30 years experience in the field of engineering ceramics, BCE assists its customers in questions of an optimum material choice and ceramic design for specific applications. A prototype manufacturing can be realized in short time (approx. 4–6 weeks) before launching a series production.

Production programme:

Material:
alumina, cordierite, partially stabilized zirconia, silicon carbide, silicon nitride, steatite, tetragonal stabilized zirconia, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:
electrical and thermal insulation, electronics and sensors, energy technology/power generation, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, household and luxury goods, laboratory technology, laser technology, mechanical and chemical process engineering, medical technology, metal industry, optics, photovoltaics, plasma treatment, semiconductor industry, vacuum technology

Production plant: after firing machining, assembling, bonding, cleaning, debinding, fast ceramic production, finishing, grinding, hard machining, HIP, isostatic pressing, lapping, polishing, sintering, ultrasonic assisted machining, unfired machining

Market leadership: short time manufacturing of customised ceramic components, consultancy with suitable-to-ceramic construction design

Special know-how: green machining, cold-isostatic pressing, hard machining

Certificates: DIN EN ISO 9001 : 2015

Product development partnerships: customers, institutes, user industries, multidisciplinary

Product funding: public, industry

Pilot run series: yes

Project duration:
approx. 4–6 weeks

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:**

BOLLBRANIC GmbH
Europaring 3-5, 50170 Kopen, Germany
E-mail: info@bollbranic.com

Ownership:
Boll & Kirch Filterbau GmbH

Management:
Celina Brammer

Production programme:

Material:
silicon carbide

User industry:
environmental technology, industrial, marine and railway

Production plant: after firing machining, bonding, CIP, coating, debinding, grinding, hard machining, lapping, laser machining, rapid prototyping, sintering

Certificates: ISO 9001 : 2015

Product development partnerships: customers, institutes

Pilot run series: yes

Part of the technology group

CERAMIC APPLICATIONS

NEW

Company profile:

BOLLBRANIC GmbH is a young business specialized in manufacturing, research and development of silicon carbide membranes. We mainly manufacture tubular silicon carbide membranes with different channel and diameter geometries. Our membranes are available in pore sizes down to a few nanometers. The membranes are characterized by constant process stability, chemical resistance, high flux and good cleanability.

**Company name / Address details:**

Bosch Advanced Ceramics / grow platform GmbH
Robert Bosch Straße 1, 87509 Immenstadt, Germany
Tel.: +49 (0) 8323 20 3694
E-mail: advanced.ceramics@bosch.com

Homepage:
www.bosch-advanced-ceramics.com

Production programme:

Material:
alumina, alumina high purity, functional coatings, partially stabilized zirconia, tricalcium phosphate, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:
electrical and thermal insulation, electronics and sensors, energy technology/power generation, fluid handling technology, food and beverage, friction reduction, high temperature applications, laboratory technology, laser technology, mechanical and chemical process engineering, medical technology, optics, technical ceramics

Production plant: after firing machining, assembling, bonding, CIM, CIP, cleaning, coating, debinding, grinding, hard machining, lapping, laser machining, polishing, rapid prototyping, sintering

Market leadership: ceramic grinding discs for fully automated coffee appliances

Special know-how: CIM and 3D-printing

Certificates: ISO 9001

Product development partnerships: customers, institutes, user industries, multidisciplinary

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Bosch is synonymous with quality and precision in the field of high-performance ceramics for the automotive sector. Advanced Ceramics, the product area ceramic of grow platform GmbH is now tapping into new markets and also offering functional components made of high-tech-ceramics for consumer goods, industrial, electronically and medical engineering markets. Based on a combination of innovative manufacturing technologies and Bosch's own material systems we develop highly innovative and precise ceramic products.

**Company name / Address details:**

Carborundum Universal Limited
47,48 (part) SIPCOT Industrial Complex, 635 126 Hosur, India
Tel.: +91 (0) 4344 304700
Fax: +91 (0) 4344 276028
E-mail: customercare@cumimurugappa.com

Homepage: www.cumimurugappa.com/ceramics/ic

Ceramic division(s): CUMI Industrial Ceramics

Turnover total:
USD 405 million overall CUMI, USD 147 million for Industrial Ceramic Division

Ownership:
M. M. Murugappan

Management:
N. Ananthasheshan, Rajesh Khanna, Dr. Shyam S. Rao

Company profile:

CUMI Industrial Ceramics is a leading global player in Advanced Ceramics, serving customers in sustainable energy generation & distribution, mobility, advanced wear protection, electronics, semiconductors and others. Our continuous endeavour is to create Sustainable value for our customers by designing, co-creating and manufacturing high-performance advanced ceramics and materials, in line with our purpose of "Making a Material Difference".

Number of employees: total: 921; in R+D: 10

Production programme:

Material:
alumina, EDM machinable ceramic material, machinable ceramics, partially stabilized zirconia, RBSiC (silicon-infiltrated reaction-bonded silicon carbide), silicon carbide, Sintered silicon carbide, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:
air purification, armour, electrical and electronic industry, electronics and sensors, energy technology/power generation, fluid handling technology, food and beverage, friction reduction, furnace and kiln manufacturer, heat treatment, high temperature applications, mechanical and chemical process engineering, metal industry, oil and gas, power generation, sensors, substrates, textile, vacuum technology, X-ray technology

Products:
ceramic coatings, ceramic insulators, ceramic lined bend, ceramic lined cyclone, ceramic lined flexible rubber hose, ceramic liners, ceramic rings, ceramic seals, ceramic special tiles, electric resistant products – cylinders grinding media, locating pins plungers, reaction-bonded silicon carbide, sand blasting nozzle, spark plug, wear and thermal resistant products, wear and impact resistant pad zirconia

Main components: metallized ceramic, wear-resistant ceramic solutions including lined equipment and engineered ceramics; provides design and installation support

Production plant: 3D measuring, after firing machining, bonding, brazing of metal-ceramic assemblies, casting, CIM, CIP, cleaning, coating, dry pressing, extrusion, grinding, isostatic pressing, lapping, polishing, slipcasting, unfired machining, uniaxial pressing, vacuum/gas pressure sintering

Market leadership:
metallized ceramic, wear resistant ceramic solutions including lined equipment

Special know-how: ceramic material preparation/processing, metallized ceramics (ceramic-to-metal seals)

Certificates: ISO 9001 : 2015, ISO 14001 : 2015, ISO 45001 : 2018, ISO 3834-2 : 2015, EcoVadis CSR Silver Rating

Product development partnerships: customers, institutes, user industries

Project funding: industry

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:**

Ceramaret AG
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Ceramaret GmbH
Ziegelstraße 9a, 01662 Meißen, Germany
Tel.: +49 (0) 3521 71955 0
E-mail: sales-de@ceramaret.com

Homepage:
www.ceramaret.ch

Ownership: private

Management:
Gilles Robert, CEO;
Andreas Ziegert, Managing Director Ceramaret GmbH Meissen;
Hugues Leuzinger, VP Marketing & Sales

Number of employees:
total: 324; in R+D: 19

Company profile:

Ceramaret designs and produces components out of the hardest of materials such as advanced ceramics (zirconia, alumina and different composites, silicon carbide and silicon nitride) as well as synthetic sapphire or ruby. All steps of the manufacturing process from engineering, mould making, pressing, sintering up to finish machining are performed in house to guarantee the required quality level. From prototype to high volume production batches, Ceramaret works with its customers on continuous improvement process and on convenient logistic agreements. On January 2018, Ceramaret AG acquired MicroCeram in Meißen/DE. The 2 companies now work together under the Ceramaret name and fully use existing synergies.

Production programme:

Material:
alumina and platelet reinforced zirconia, alumina high purity, high purity alumina porous ceramics, machinable ceramics, partially stabilized zirconia, polycrystalline silicon carbide, silicon nitride, spinel, yttria-stabilized zirconia suspensions, zirconia, zirconia and platelet reinforced alumina, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:
accelerators, aerospace, automotive, automotive: flowcontrol, batteries silicon-nitride production, biotechnology, chemical industry, CIM, cutting tools, dental technology, dispensing, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, household and luxury goods, laser technology, life science industry, marine and railway, measuring and testing industry, mechanical and chemical process engineering, medical engineering, medical engineering: implantology, medical technology, oil and gas, optics, semiconductor industry, textile, vacuum technology, wear- and corrosion-protection

Main components:
ceramic piston assemblies, ceramic valve assemblies, medical isolators, check valve assemblies, validation series of high volume deliveries

Production plant:

after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, ceramic feedstock, CIM, CIP, cleaning, coating, debinding, dry pressing, fast ceramic production, finishing, grinding, hard machining, HIP, hot pressing, isostatic pressing, lapping, polishing, pressing, rapid prototyping, sintering, ultrasonic assisted machining, unfired machining, uniaxial pressing, vacuum/gas pressure sintering, wet pressing

Leadership: piston and cylinders, check valves, isolators precision machining and grinding, polishing

Special know-how:
engineering, near-net-shape parts, high-precision hard material machining, assembling, validation series to high deliveries volume

Certificates: ISO 9001 / ISO 13485 / ISO 14001 / ISO 45001

Product development partnerships: customers, institutes, multidisciplinary

Fair:
analytica, Munich/DE
Ceramics Expo, Novi/US
ceramtec, Munich/DE
Compamed, Düsseldorf/DE
Hannover Messe, Hannover/DE

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****Ceramdis GmbH**

Im Tubental 5, 8352 Elsau, Switzerland
Tel.: +41 (0) 44 843 2000
Fax: +41 (0) 44 843 2001
E-mail: info@ceramdis.com

Homepage: www.ceramdis.com

Ownership: private

Management: Urs Siegenthaler

Company profile:

Ceramdis produces extruded silicon carbide and silicon nitride as round, foil, flat, tubular or custom-made profiles in electrically insulating and electrically conductive CeSinit®: Swiss quality silicon nitride. Our process is especially suitable for the economic production of thin and long ceramic components such as needles and rollers, welding jigs and locating pins, axles, and capillaries or as blanks for cutting tools. We offer custom-made components in a variety of advanced ceramics. Ceramdis has long experience in bonding techniques of ceramic-metal assemblies.

Production programme:**Material:**

CeSinit silicon nitride, silicon carbide, zirconia

User industry:

laboratory technology; coating technology; semiconductor processing equipment; electronics and sensors; metrology; automotive; process and production technology; mechanical and chemical process engineering; metal industry; fluid technology; friction reduction; wear- and corrosion-protection; biotechnology; power generation; cutting tools; heat treatment; roller and needle bearings

Production plant:

extrusion, green machining, sintering, hard machining, precision grinding, ceramic-metal assemblies and sub-assemblies

Special know-how: thermoforming and green machining of silicon nitride (CeSinit), bonding and shrinking

Certificates: ISO 9001 : 2015

Product development partnerships: customers

Pilot run series: yes

Fair:

Ceramics Expo, Novi/US

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****CeramTec GmbH**

CeramTec-Platz 1-9, 73207 Plochingen, Germany
Tel.: +49 (0) 7153 611-0
Fax: +49 (0) 7153 25421
E-mail: info@ceramtec.de

Homepage:

www.ceramtec-group.com/en

Turnover total: approx. EUR 640 million

Ownership: BC Partners, Canadian Peosion Plan

Management:

Dr Hadi Saleh CEO, Eric Oellerer CFO,
Richard Boulter President Industrial

Company profile:

CeramTec is a leading global med-tech platform with a focus on High-Performance Ceramics (HPC) solutions, and is specialized in the development, manufacturing and sale of parts, components and products made from ceramic materials. With over a century of developmental and production experience in the HPC industry, CeramTec is a global leader in the manufacturing of advanced ceramics and engineers these materials for use in a wide variety of applications. HPC from CeramTec are used in a range of areas, including critical medical applications such as hip replacements, other orthopedic implants, dental implants and medical equipment, and industries including mobility, electronics, and in other industrial applications. With production sites and subsidiaries in Europe, North and South America as well as Asia, CeramTec maintains its presence around the globe as a manufacturer and supplier. The company is headquartered in Plochingen, near Stuttgart. In 2021, CeramTec generated more than €640 million in revenues. CeramTec employs almost 3500 staff worldwide, around 2000 of which are in Germany.

Number of employees:

total: 3500

Production programme:**Material:**

alumina, alumina and platelet reinforced zirconia, partially stabilized zirconia, piezoceramic components, silicon carbide, silicon nitride, steatite, technical porcelain, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

additive manufacturing, aerospace, armour, automotive, automotive: electromobility, automotive: flowcontrol, aviation, cutting tools, defense, dental technology, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, faucet and valve discs, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, household and luxury goods, mechanical and chemical process engineering, medical and dental, medical engineering: implantology, medical technology, metal industry, optics, photovoltaics, surface treatment, textile, vacuum technology, welding, wind energy

Production plant:

3D printers, after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, CIM, CIP, coating, dry pressing, extrusion, grinding, HIP, hot pressing, isostatic pressing, lapping, polishing, rapid prototyping, tape casting, ultrasonic assisted machining, unfired machining, uniaxial pressing, vacuum/gas pressure sintering

Product development partnerships: customers, institutes, multidisciplinary

Project funding: public

Pilot run series: yes

Fair:

AAOS, Orlando/US
Compamed, Dusseldorf/DE
formnext, Frankfurt/DE
PCIM Europe, Nuremberg/DE
Sensor + Test, Nuremberg/DE
Wire & Tube, Dusseldorf/DE

Part of the technology group

CERAMIC APPLICATIONS

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html

**Company name / Address details:****Cerotec Technical Ceramics BV**

Poppenbouwing 35, 4191 NZ Geldermalsen,
The Netherlands
Tel.: +31 (0) 345 580101
E-mail: ceratec@ceratec.nl

Homepage:

www.ceratec.nl

Ceramic division(s):

Cerotec Technical Ceramics BV / Cerotec Ceramic Bearings
BV, Secondary Office at Brainport Industries Campus (BIC) in
Eindhoven

Company profile:

Innovative solutions! We are specialized in industrial components constructed from technical ceramics since 1983. Our strength lies in the total formula of problem analysis, development, prototyping and production. Ceratec provides professional support in the area of material selection, economical design and backup for incorporation of ceramic components. We have modern production facilities for processing technical ceramics. We develop and manufacture technical ceramic products for customer-specified applications. A range of standard ceramic industrial components can be promptly supplied. Production Alongside various processing techniques, special joining techniques are applied for production of composite products made of technical ceramic and metal. The requisite metal-working processes and assembly activities are carried out in-house. Ceratec produce both small and larger series. Throughout the production process, quality control is carried out in our advanced test room. Ceramic on the right spot! Ceratec Engineering guarantees professional support in the area of material selection, economical design and backup for incorporation of ceramic components. We use technical ceramics for products and components in which the material properties produce distinct added value. For instance, wear problems with metal or plastic components can be a reason for calling on the services of Ceratec Engineering. We have modern CAD systems and measuring instruments for the development and production of ceramic components and composite products.

Ownership:

Ceraholding B.V.

Management: Steven Visser (General Manager),
Tim van Kampen, Haske van Zadelhoff

Number of employees:

total: 35

Production programme:**Material:**

aluminium nitride AlN, boron nitride, composites/fibres, silicon, silicon carbide, silicon nitride, zirconia

User industry:

automotive, aviation, space travel; electronics and sensors; energy technology/power generation; environmental technology; friction-reduction, wear- and corrosion-protection, heat treatment, mechanical and chemical process engineering, medical technology, metal industry

Production plant: assembling, bonding, hard machining, rapid prototyping, unfired machining

Certificates: ISO 9001 : 2015

Product development partnerships: customers, institutes, user industries, multidisciplinary:

Project funding: public, industry

Project duration: 1–12 months

Pilot run series: yes

Fair:

ACHEMA, Frankfurt/DE

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****Creatz3D Ceramics Pte Ltd**

180 Paya Lebar Road, #08-07, Yi Guang Factory Building,
(S) 409032 Singapore, Singapore
Tel.: +65 6631 8555
E-mail: contact@c3d-ceramics.com

Homepage: www.c3d-ceramics.com

Company profile:

Creatz3D Ceramics is a specialized key division of Creatz3D, dedicated to the research and development of high-performance 3D-printing ceramic applications. Leveraging on decades of expertise in 3D-printing, Creatz3D Ceramics specializes in the designing of concept prototypes to batch manufacturing for a diverse range of materials like alumina, zirconia, aluminium nitride, and more. By relying on our expertise, companies can avoid going down the tedious traditional route with ceramics 3D-printing, and achieve similar added value in the manufacturing chain where accuracy and repeatability are crucial. Combined with 3D printing technology, companies can now create new complex designs such as complex manifolds, honeycombs, micro-lattice structures and many more. Contact us and challenge us with your needs regardless of whether it's customized single component to serial production requirements.

Production programme:**Material:**

alumina, aluminium nitride, zirconia

User industry:

additive manufacturing, electronics and sensors, fluid handling technology, high temperature applications, mechanical and chemical process engineering, medical technology, optics, photovoltaics, plasma treatment, R&D (universities/institutes/corporate), semiconductor industry, technical ceramics

Production plant: 3D printers, additive manufacturing, after firing machining, rapid prototyping, sintering

Special know-how: design for additive manufacturing for ceramics parts

Product development partnerships: customers, institutes, multidisciplinary

Project funding: industry: yes

Pilot run series: yes

Fair:

Ceramics Expo, Novi/US

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****DOCERAM GmbH**

Hesslingsweg 65-69, 44309 Dortmund, Germany
Tel.: +49 (0) 231 9250 00 444
E-mail: info@doceram.com

Homepages:

www.doceram.com; www.moeschter-group.com

Company profile:

DOCERAM GmbH is a partner of the industry for innovative components and parts from high-performance ceramics. Extremely heat-resistant, impact resistant, and low-adhesion components will be delivered – from prototypes up to series production – based on aluminium oxide, zirconium oxide, and silicon nitride, for a material range of components and assemblies. A range of applications includes general mechanical and plant engineering, the automotive industry and its suppliers, welding and forming technology, as well as numerous other industries. DOCERAM GmbH is a development and production partner of major OEMs and medium-sized enterprises. DOCERAM is one subsidiary of the in Dortmund-based MOESCHTER Group which is specialized in high-performance materials. The group has three independent companies under its umbrella: DOCERAM, DOTHERM and ISOCOS, each of which develops and markets professional solutions for industrial applications in their specific fields. DOTHERM and ISOCOS manufacture electrical and thermal insulation using engineering plastics, fibre-plastic composites and state-of-the-art high-tech materials.

Production programme:**Material:**

machinable ceramics, partially stabilised zirconia, silicon nitride, zirconia, zirconia toughened alumina/alumina toughened zirconia ZTA/ATZ

User industry:

electronics and sensors, food and beverage, heat treatment, high temperature applications, mechanical and chemical process engineering, medical technology, metal industry, technical ceramics

Production plant: after firing machining, assembling, CIM, CIP, dry pressing, fast ceramic production, grinding, unfired machining, uniaxial pressing

Market leadership: automotive welding and assembly lines

Special know-how:

automotive standards for car body construction, production from individual part to large-batch production

Certificates:

ISO 9001 / ISO 14001 : 2015

Product development partnerships: customers, institutes, user industries, multidisciplinary

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****Elstein-Werk M. Steinmetz GmbH & Co. KG**

Stettiner Straße 14, 37154 Northeim, Germany
Tel.: +49 (0) 5551 983 0
Fax: +49 (0) 5551 983 61
E-mail: info@elstein.com

Homepage: www.elstein.com

Production programme:*User industry:*

electrical and thermal insulation, electronics and sensors, food and beverage, heat treatment, high temperature applications, medical technology, OEM, plastic industry, surface treatment, technical ceramics, thermal engineering, thermofforming, vacuum technology

Main components: heating elements

Production plant: bonding, casting, coating, diamond grinding, extrusion, fast ceramic production, furnace linings/re-linings, glazing, mold making, polishing, rapid prototyping

Market leadership: Using German-made Elstein Infrared Heaters = interruption-free production processes | highest energy efficiency = lowest operating costs = best possible price-performance ratio

Special know-how: based on the invention of the first full-cast-ceramic infrared heater, Elstein-Werk was founded in 1950. Since that time, we develop and manufacture ceramic infrared emitters based on own patents, own engineering and production in Germany. Our products are universally applicable and determine worldwide the state-of-the-art. Based on the highest possible quality and performance level, our heating elements and systems completely fulfill all demands that OEM customers and users expect from the ceramic infrared emitter. Now and well into the future.

Certificates: CE / UL / VDE

Product development partnerships: customers, institutes, user industries

Project funding: industry

Fair:

K Plastics Trade Fair, Dusseldorf/DE

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****ETI Elektroelement d.o.o.**

Obrezja 5, 1411 Izlake, Slovenia
Tel.: +386 (0) 356 5757 0
Fax: +386 (0) 356 74077
E-mail: eti@eti.si

Homepages: www.etigroup.eu

Turnover: EUR 140 million

Ownership: private

Company profile:

ETI is a company with more than 70 years' tradition. We grew from a small ceramic manufacturer into a group with more than 1600 employees, selling to more than 60 countries all over the world. We are organized into three business divisions: technical ceramics, fuses and switchgear manufacturing. The group consists of more than 15 companies with production locations in several European countries. Ceramic division is only present in Slovenia, with more than 250 employees and two manufacturing plants. Most of technical ceramic products are custom made and manufactured from silicate and alumina ceramics. ETI technical ceramic products are present in many industrial applications worldwide, such as automotive industry, electrical industry and electronics, heating applications, household appliances etc.

Number of employees: total: 1600

Production programme:*Material :*

alumina, cordierite, corundum, mullite porcelain, steatite, technical porcelain

User industry:

electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, friction reduction, heat treatment, high temperature applications, household and luxury goods, laboratory technology, mechanical and chemical process engineering, photovoltaics, refractories

Production plant:

after firing machining, assembling, casting, CIM, dry pressing, extrusion, finishing, glazing, grinding, pressing, rapid prototyping, sintering, wet pressing, white and green body processing

Certificates: ISO 9001:2015, 14001:2015, IATF 16949:2016

Product development partnerships: customers, institutes, user industries

Project funding: public, industry

Pilot run series: yes

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****HENZE Boron Nitride, Products AG**

Grundweg 1, 87493 Lauben, Germany
Tel.: +49 (0) 8374 58997 0
Fax: +49 (0) 8374 5899799
E-mail: info@henze-bnp.de

Homepage: www.henze-bnp.de

Turnover: EUR 12 million

Ownership: Henze AG

Management: Christoph Henze, Matthias Henze

Number of employees: total: 52; in R+D: 3

Production programme:*Material:*

boron nitride, machinable ceramics

User industry:

electronics and sensors, energy technology/power generation, friction reduction, high temperature applications, Increased of thermal conductivity in plastics, metal industry, photovoltaics, plasma treatment, refractories, semiconductor industry, surface treatment, vacuum technology

Production plant: 3D-measuring, finishing, hard machining

Special know-how: customer-specific developments for sintered boron nitride components, boron nitride powder, boron nitride coatings and boron nitride oil dispersions/individual consulting for the optimal boron nitride material and all suitable areas of industrial application/own laboratory for quality assurance and product development

Certificates: ISO 9001, ISO 14001

Product development partnerships: customers, institutes, user industries, multidisciplinary

Fair:

ceramtec, Munich/DE

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

HENZE BNP is a leading specialist in innovative products manufactured from hexagonal boron nitride. Our place of business is located in Lauben, near Kempten in southern Germany with a team of 50 employees. The young and dynamic family business was founded by Peter Henze in 1993 and is now managed by two of his sons, Christoph and Matthias Henze. One of our main business is the machining of technical ceramics made from sintered boron nitride, for various high temperature applications, like plates, rods, spacers, cylinders, hollow parts, tubes, rollers, crucibles, nozzles and stoppers. We manufacture sintered boron nitride to the exact customer requirements by using the latest state-of-the-art machining centres. Parts can be produced in a seemingly endless variety of shapes and sizes also in complex geometries. Due to the high purity of the raw materials used for our HeBoSint® products, the final product ensures process security, reducing breakdowns. Our product range also includes boron nitride powder, coatings, sprays and lubricant oil additives. We develop creative and tailor-made solutions for and with our customers. They profit from our advice and know-how in an ongoing dialogue, that often leads to completely new and customer specific developments. Our quick decision making processes, flexibility, as well as our ability to think outside of the box are key. We supply more than 30 industrial sectors worldwide.

Heraeus

Company name / Address details:

Heraeus High Performance Coatings
Heraustrasse 12-14, 63450 Hanau, Germany
Tel.: +49 (0) 6181 35 3273
E-mail: thomas.stoecker@heraeus.com

Homepage: www.heraeus-high-performance-coatings.com/

Production plant: coating, metallizing

Product development partnerships: customers, institutes

Fair:
Ceramics Expo, Novi/US
Ceramics Japan, Tokyo/JP

NEW

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Heraeus High Performance Coatings is a start-up of the Heraeus Group, headquartered in Hanau, Germany and has specialized in aerosol coating. Aerosol Deposition enables the formation of unique metal and ceramic coatings at room temperature on all types of material surfaces. Heraeus High Performance Coatings accompanies customers all the way from initial feasibility study to introducing this new process into series production. Heraeus, headquartered in Hanau, Germany, is a leading international family-owned technology group. The company's roots go back to a family pharmacy started in 1660. Today, the Heraeus group includes businesses in the environmental, electronics, health and industrial applications sectors. Customers benefit from innovative technologies and solutions based on broad materials expertise and technological leadership.

In the 2021 financial year, the FORTUNE Global 500 listed group generated revenues of EUR 29.5 billion (USD 34.9 billion) with approximately 16 200 employees in 40 countries. Heraeus is one of the top 10 family-owned companies in Germany and holds a leading position in its global markets.



Company name / Address details:

International Syalons (Newcastle) Ltd
Stephenson Street, Newcastle upon Tyne, NE28 6TT,
Great Britain
Tel.: +44 (0) 191 295101 0
E-mail: enquiries@syalons.com

Homepage: www.syalons.com

Management: Ben Melrose, Mick Bell

Number of employees:
total: 39
in R+D: 4

Production programme:

Material:
alumina, EDM machinable ceramic material, partially stabilized zirconia, Si₃N₄, SiAlON, silicon carbide, silicon nitride, tetragonal stabilized zirconia, wear resistant advanced ceramic material, zirconia

User industry:
armour, cutting tools, electrical and thermal insulation, electronics and sensors, energy technology/power generation, friction reduction, high temperature applications, mechanical and chemical process engineering, metal industry, oil and gas, R&D (universities/institutes/corporate), refractories, technical ceramics, wear- and corrosion-protection

Production plant:

after firing machining, bonding, calcination, casting, CIP, debinding, dry pressing, finishing, green machining, grinding, hard machining, isostatic pressing, lapping, mold making, polishing, powder processing, pre-firing machining, pressing, sintering, unfired machining, uniaxial pressing, vacuum/gas pressure sintering

Market leadership:

silicon-nitride-based advanced ceramics, aluminium foundry, automotive welding, oil and gas

Special know-how:

silicon-nitride-based SiAlON materials

Certificates: ISO 9001 : 2015

Product development partnerships: customers, institutes, user industries, multidisciplinary

Fair:

The Advanced Ceramics Show, Birmingham/GB

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

With nearly forty years experience in the production and development of advanced engineering ceramics, **International Syalons (Newcastle) Ltd (ISN)** are experts in the field. We are based in the North East of England and are the GB's leading manufacturer of syalon and silicon nitride based ceramic products and powders in GB. In addition, we can offer a range of advanced engineering ceramic solutions such as alumina, zirconia and silicon carbide and can offer a complete solution to your advanced ceramic requirement. Syalons are advanced silicon nitride based ceramics and are amongst the strongest and most durable ceramic materials known. Their outstanding properties allow them to compete with other engineering ceramics and refractories such as zirconia (ZrO₂), alumina (Al₂O₃) and silicon carbide (SiC) in many diverse industrial applications. Syalons, also known as SiAlONs, were the world's first commercially available advanced ceramic alloys.

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**Company name / Address details:****KERAFOl****Keramische Folien GmbH & Co. KG**

Koppe-Platz 1, 92676 Eschenbach, Germany

Tel.: +49 (0) 9645-88 480

Fax: +49 (0) 9645-88 390

E-mail: cts@kerafol.com

Homepage:

www.kerafol.com

Ceramic division(s): 5**Ownership:**

Full privat

Management:

Franz Koppe, Isabell Koppe, Sabine Koppe, Willi Neumüller

Number of employees:

total: 240

Company profile:

KERAFOl® – Keramische Folien GmbH & Co. KG was founded in 1985 and has over 200 employees at the moment. We develop and produce ceramic tapes for versatile applications with a special manufacturing process. These tapes may then be used unsintered as a final product or sintered as a planar ceramic component. All products of our department Ceramic Tapes & Substrates (CTS) are produced at KERAFOl® in Eschenbach in der Oberpfalz (Bavaria, Germany). KERAFOl® can therefore offer its customers smaller series production to an attractive cost-performance ratio. The premises are located in an area where still space for expansion exists. Many years of experience with ceramic materials, continuous development of innovative and customer-focused solutions and a global sales and distribution network with short delivery times and a fast reaction time are just some of the reasons, why we are one of the leading specialists and manufacturers of thinfilm/thick-film substrates, electrolytes and MEA for SOFC/SOE applications, special kiln furniture and ceramic wear-protection substrates. Our ceramic green tapes, substrates and setter plates are produced in a continuous process on the latest production facilities either for standard or customer specific products. For customized geometries the ceramic green tape products can be cut by laser or customized punching tools. The sintered substrates and setter plates can be machined into customer specific dimensions by laser- or waterjet cutting. All KERAFOl® products are manufactured under the quality assurance standard EN ISO 9001 : 2015 and environmental assurance standard EN ISO 14001. In order to offer our customers competent, customized advice and individual problem solutions, our engineers and staff are constantly doing research, development and tests on new, innovative and high quality materials in our in-house R&D laboratory. KERAFOl® offers a wide range of products, suitable for diverse applications, for example in sensors for oxygen, temperature and humidity control, microelectronics, special kiln furniture, SOFC, SOE, solid electrolyte separators, cross-flow filtration, aeration and special wear protection. Our foremost goal is to provide our customers with competent, customer oriented product solutions, which we guarantee through continuous quality control, optimization of processes and manufacturing steps.

Production programme:**Material:**

alumina, alumina high purity, corundum, heat radiation ceramic, high purity alumina porous ceramics, partially stabilized zirconia, tetragonal stabilized zirconia, wear resistant advanced ceramic material, yttria-stabilised zirconia (3% / 8%), zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina/ alumina toughened zirconia ZPTA/APTZ

User industry:

additive manufacturing, aerospace, armour, automotive, battery, ceramic industry, chemical industry, CIM, consumer goods, cutting tools, defense, dental technology, electrical and thermal insulation, electrical engineering, electronics and sensors, energy storage, energy technology/power generation, environmental technology, food and beverage, friction reduction, furnace and kiln manufacturer, heat treatment, high temperature applications, industrial, industrial automation, insulated appliances, kiln furniture, laser technology, measuring and testing industry, mechanical and chemical process engineering, medical and dental, medical technology, metal industry, metallurgy, metrology, non-ferrous metallurgy, oil and gas, optics, process and production technology, processing industry, R&D (universities/institutes/corporate), refractories, sensors, substrates, technical ceramics, thermal engineering, tribology, watch industries, wear- and corrosion-protection

Products:

Keralpor 99, Keralpor S, K99TF, Keral 99, Keral 96, Keraprotec, 3YSZ-Sensor, ATS, Cross-Fow Filter Discs, Zirconia electrolytes, Keralpor 99 Z

Production plant:

after firing machining, coating, debinding, fast ceramic production, green machining, high temperature kilns, kilns, laser machining, polishing, sintering, tape casting

Market leadership:

ceramic tape casted products for advanced applications

Special know-how:

tape casting, debinding, sintering, R&D, raw material sourcing, engineering

Certificates: DIN EN ISO 9001 2015, DIN EN ISO 14001

2015, IATF 16949 since 2018, ROHS compliant, REACH compliant

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry.

Pilot run series: yes

Project duration: 2–24 months

Fair:

Ceramics Expo, Novi/US
ceramitec, Munich/DE
EURO PM2023, Lisbon/PT

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****Kläger Spritzguss GmbH & Co. KG**

Hochgerichtstr. 33, 72280 Dornstetten, Germany

Tel.: +49 (0) 7443 9633 0

Fax: +49 (0) 7443 963388

E-mail: info@klaeger.de

Homepage: klaeger.de**Ownership:** Prof. Dr.-Ing. Roland Kläger**Management:**

Prof. Dr.-Ing. Roland Kläger;
ppa. Hardy Schelkus, Plant Manager;
ppa. Jens Graf, Director Sales & Marketing

Number of employees: total: >100; in R+D: 3

Company profile:

Kläger is one of the leading manufacturers in the field of ceramic injection moulding. The company's core competence is the injection moulding of precision components made of technical ceramics and plastics. In this context, Kläger offers both individual parts and complete assemblies made of different components and acts as a development partner and system supplier.

Based on a highly integrated value chain — engineering, mould making, injection moulding — Kläger offers project takeover from product development to tool making to the finished series component and its production. Kläger offers a high variety of materials (Al_2O_3 , ZTA-ATZ / ZrO_2) and is technically capable of processing all feedstock systems available on the market. A wide range of different debinding and sintering systems offers the most technically and economically sensible processing, depending on the material, number of pieces and component size. The in-house integrated mould service, fully automatic injection moulding systems and permanent quality monitoring guarantee high output quantities with consistent quality, especially in large-scale production.

Production programme:**Material:**

alumina, coloured zirconia, high purity alumina porous ceramics, partially stabilized zirconia, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

automotive: electromobility, automotive: electronic circuits, automotive: exhaust train, automotive: flowcontrol, chemicals: tablet production, dental technology, electrical and thermal insulation, electronics and sensors, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, household and luxury goods, laboratory technology, measuring systems: thermal measurements, mechanical and chemical process engineering, medical engineering: implantology, medical technology, textile, vacuum technology

Production plant:

after firing machining, assembling, CIM, debinding, finishing, grinding, hard machining, lapping, mold making, polishing, sintering

Special know-how:

production of all commercial available compounds possible; own material development; system solutions out of ceramic, plastic and metal; engineering; mold-making inhouse; prototypes and small series by mechanical preparation, additive manufacturing, injection molding with rapid tools, using any kind of feedstock-system

Certificates:

ISO 9001-2015; Best Component Award Technical Ceramics 2018: 2nd Place

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: industry

Project duration: 6–36 months

Pilot run series: yes

Fair:

ceramitec, Munich/DE

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:**

KYOCERA Fineceramics Europe GmbH
Steinzeugstr. 92, 68229 Mannheim, Germany
Tel.: +49 (0) 621 40547 349
E-mail: info-kyocera@kyocera-solutions.de

Homepage:
kyocera-solutions.de

Turnover:
total EUR 13,4 billion; KFSG EUR 49 million

Ownership: KYOCERA Europe GmbH

Management: Armin Kayser

Number of employees:
total: KYOCERA Fineceramics Europe GmbH 320
KYOCERA 83 000 worldwide

Company profile:

KYOCERA Fineceramics Europe GmbH produces components based on customer specifications and also has an extensive programme of standard high-performance ceramics. The product dimensions range from a few millimetres up to about 2 m. KYOCERA Fineceramics Europe GmbH stands for an experienced team of innovative application engineers, experimental production specialists and conscientious quality assurance. Our philosophy is to support our customers in the ceramic material selection, design and project execution. More than 150 years of experience in ceramic production, new-developed materials coupled with innovative engineering are the pillars of the successful development of the company the last three decades.

Production programme:

Material:
alumina, cermet, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:
accelerators, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, laboratory technology, mechanical and chemical process engineering, medical technology, metal industry, optics, photovoltaics, refractories, semiconductor industry, surface treatment, textile, vacuum technology

Production plant:
after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, CIM, CIP, coating, dry pressing, extrusion, fast ceramic production, finishing, grinding, hard machining, HIP, hot pressing, isostatic pressing, lapping, polishing, powder processing, pressing, rapid prototyping, sintering, ultrasonic assisted machining, unfired machining, uniaxial pressing, vacuum/gas pressure sintering, wet pressing

Market leadership:
huge parts/ containment shells/ceramic-metal-assemblies (e.g. components for accelerators or sensors)

Special know-how:

material development, processing and grinding, rapid prototyping

Certificates:

TÜV Cert DIN ISO EN 9001 / TÜV Cert DIN ISO EN 14001
Quality Management System audited according to Directive 2014/68/EU, acc. to EN 764-5

Product development partnerships: customers, institutes

Project funding: industry

Project duration:
completely different, rapid prototyping

Pilot run series: yes

Fair:

ACHEMA, Munich/DE
ceramtec, Munich/DE
The Advanced Ceramics Show, Birmingham/GB
Wire & Tube, Düsseldorf/DE

Part of the technology group

[CERAMIC APPLICATIONS](#)

**Company name / Address details:**

Macea Ceramica Tecnica Ltda
Rua Engenheiro Prudente 65, 01550-000 Sao Paulo SP, Brazil
Tel.: +55 (0) 11 2063 0660
Fax: +55 (0) 11 2063 7644
E-mail: macea@macea.com.br

Homepage:
www.macea.com.br

Number of employees:
total: 40
in R+D: 5

Production programme:

Material:
alumina, alumina high purity, BB4C reactionbonded boron carbide, boron carbide, boron nitride, coloured zirconia, cordierite, corundum, direct-sintered silicon carbide, graphite, machinable ceramics, mullite, partially stabilized zirconia, porcelain, silicon nitride, steatite, technical porcelain, titania, tungsten carbide, wear resistant advanced ceramic material, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:
armour, CIM, clay industry, dental technology, electrical and thermal insulation, environmental technology, food and beverage, friction reduction, heat treatment, high temperature applications, kiln furniture, metal industry, OEM, refractories, surface treatment, technical ceramics, textile

Production plant:
after firing machining, assembling, casting, CIM, debinding, diamond grinding, dry pressing, glazing, grinding, isostatic pressing, lapping, laser machining, polishing, pressing, sintering, tape casting, uniaxial pressing

Market leadership: textile, petrochemical, pumps, mechanical seals, wear resistance, wire industry, refractories, welding industry, sugar cane, fiberglass, macor and ceramic balls, oxygen sensor end user

Special know-how: CIM, dry pressing, isostatic pressing, slip casting, grinding, debinding, sintering, surface treatment

Certificates: ISO 9001 : 2015

Product development partnerships: customers, institutes, user industries

Project funding: industry

Pilot run series: yes

Project duration: 24 months

Fair:

Expomin, Santiago/CL
Feimec, Sao Paulo/BR

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[CERAMIC APPLICATIONS](#)

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html

maxon

Company name / Address details:

maxon motor GmbH
Untere Ziel 1, 79350 Sexau, Germany
Tel.: +49 (0) 7641 9114 0
E-mail: ceramic.de@maxongroup.com

Homepage:
www.maxongroup.com

Number of employees:
total: 530 / 45 in CIM/MIM

Company profile:

maxon is an international supplier for high precision and high quality ceramics with more than 25 years of development and production expertise. A wide variety of ceramic parts, made of zirconia and aluminum oxide, are produced by injection molding, sintering and machining. With this vast vertical range of manufacture, maxon produces high-tech ceramics with tight tolerances of up to 1 µm. Ceramics from maxon are used in the watch industry, medical industry, consumer industry, drive solutions and in many other applications. Since 1961, maxon is the worldwide leading supplier of high precision drives with 3300 employees and subsidiaries in more than 40 countries.

Production programme:

Material:
alumina, coloured zirconia, silicon carbide, silicon nitride, zirconia

User industry:
electrical and thermal insulation, electrical engineering, electronics and sensors, fluid handling technology, food and beverage, heat treatment, household and luxury goods, industrial automation, laboratory technology, laser technology, marine and railway, measuring and testing industry, mechanical and chemical process engineering, medical technology, metrology, optics, plastic industry, R&D (universities/institutes/corporate), technical ceramics, vacuum technology, watch industries

Production plant:

3D measuring, 4th/5th axis machining, after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, CIM, debinding, diamond grinding, digital microscoping, extrusion, finishing, grinding, grinding cut-to-size, hard machining, laser machining, micromachining, milling, MIM, polishing, sintering, turning, unfired machining, white and green body processing

Market leadership: familiar with driving systems, we are specialists for precisely grinded spindles and axles as well as parts for mechanical wristwatch movement made of ZrO₂

Special know-how: ceramic injection molding of small parts, ceramic lead screws for small drive systems

Certificates: ISO 9001:2015, ISO 14001:2015

Product development partnerships: customers, institutes, user industries

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CERAMIC APPLICATIONS



Company name / Address details:

MERSEN BOOSTEC
ZAE Ceram'Innov Pyrénées, 65460 Bazet, France
Tel.: +33 (0) 562 334 500
Fax: +33 (0) 562 334 505
E-mail: boostec@mersen.com

Homepage:
www.mersen.de

Ownership:
Mersen Group 95 % and Airbus Defence & Space 5 %

Management: Jérôme Lavenac

Company profile:

Over the years, **MERSEN BOOSTEC** has developed a unique expertise in the manufacture of very large and complex SiC parts or assemblies, possibly coated with SiC CVD. After having developed its leadership in space or terrestrial SiC optics, MERSEN BOOSTEC has successfully diversified into the fields of laser processing, equipment for semiconductor industry and chemical industry.

Production programme:

Material:
sintered silicon carbide (Boostec® SiC); CVD SiC

User industry:
armour, brazing, chemical industry, coating technology, electronics and sensors, heat treatment, kiln furniture, laser technology, marine and railway, measuring and testing industry, mechanical and chemical process engineering, metrology, navy, non-ferrous metallurgy, nuclear industry, OEM, optics, R&D (universities/institutes/corporate), scientific instrumentation, semiconductor industry, Space and astronomy, technical ceramics, vacuum technology

Production plant:

3D measuring, assembling, bonding, CIP, cleaning, CMM and laser tracker, coating, debinding, diamond grinding, finishing, green machining, grinding, hard machining, isostatic pressing, lapping, milling, non-destructive inspecting, polishing, powder processing, sintering

Market leadership:

full-SiC space telescopes, laser galvo scanning mirrors, SiC modules for continuous flow reactors, very large highly stable structures

Special know-how:

assistance to customers for the design of their SiC parts or assemblies, manufacturing expertise in very large (up to Ø 3,5 m) and complex parts and/or assemblies made of sintered SiC, space qualification

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

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ASK FOR YOUR INDIVIDUAL OFFER FOR REGISTRATION!

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**Company name / Address details:**

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 Neuhausstr. 4-10, 52078 Aachen, Germany
 Tel.: +49 (0) 241 93677 0
 Fax: +49 (0) 241 93677 15
 E-mail: info@schupp-ceramics.com

Homepage:
www.schupp-ceramics.com

Turnover:
 EUR 9,4 million (2019)

Ownership:
 privately owned

Management:
 Michael E. Schupp, Owner and Managing Director

Number of employees:
 total: over 41
 in R+D: 3

Production programme:

User industry:
 CIM, dental technology, electrical and thermal insulation, electronics and sensors, energy technology/power generation, furnace and kiln manufacturer, heat treatment, high temperature applications, laboratory technology, medical technology, metal industry, refractories, semiconductor industry, surface treatment, technical ceramics, vacuum technology

Main components:

MolyCom®-Ultra 1700, 1800, 1850 & MolyCom®-Hyper 1800, 1800SC, 1800AP: molybdenum disilicide heating elements (MoSi₂) up to 1820 °C element temperature; MolyCom® accessories: accessories for connection of electric heating elements made of molybdenum disilicide (MoSi₂); MolyTec: electric heating systems (MoSi₂ + PCW) up to 1550 °C application temperature; UltraBoard & UltraVac: high-temperature insulation boards and vacuum formed shapes made of polycrystalline mullite/alumina wool (PCW) up to 1800 °C application temperature; ITM-Fibermax®: high-temperature wool (un-chopped, chopped) and needled blankets made of polycrystalline mullite/alumina wool (PCW) up to 1600 °C application temperature; PTCR: process temperature control rings from 560 °C to 1750 °C; FiberPlast C 1800 D: high temperature adhesives and coatings (PCW) up to 1750 °C application temperature; UltraSaggar and UltraSetter UV 1600-10: light kiln furniture made of PCW for sintering and firing up to 1600 °C application temperature.

Production plant:

furnace linings/re-linings, high temperature kilns, MoSi₂ heating elements (production network), vacuum forming production

Market leadership:

dental technology – high purity heating elements called MolyCom®-Hyper 1800 for discolouration-free sintering of zirconia; insulation materials made of polycrystalline mullite/alumina wool (PCW) as an alternative for refractory ceramic fibres (RCF), process temperature control rings (PTCR) for precise measurement and control of firing processes, sintering and firing setters and saggars securely hold small workpieces during the sintering / firing process

Special know-how:

MoSi₂ heating elements, PCW materials, vacuum forming, furnace linings/re-linings, machined insulation shapes, high temperature adhesives and coatings, kiln furniture

Certificates: ISO 9001:2015

Product development partnerships: customers, institutes, user industries

Project funding: public

Project duration: depending on project

Pilot run series: yes

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CERAMIC APPLICATIONS

Company profile:

SCHUPP® Ceramics is an established specialist for high-temperature technology. Since 1996, our family-owned company has been producing and selling economic while also high-quality metallic-ceramic solutions for sintering, firing and melting, as well as heat treatments. In combustion or electrically operated industrial and laboratory furnaces: Our products, components and systems work safely at temperatures of 560 °C to 1800 °C. From tried-and-tested standard products for high-precision firing process control to individual special productions for electrical heating or thermal insulation, we supply standardised and customised solutions to customers from around the world from industrial applications and production as well as research. Flexibility and targeted approaches are our foundations for meeting our customers' demands. Our international team of more than 41 employees is currently working for 900 clients around the world with head, hand and heart. Trust, honesty and the will to make a difference are our principles for establishing successful partnerships and designing them sustainably.

**Company name / Address details:**

METOXIT AG
 Emdwiesenstrasse 6, 8240 Thayngen, Switzerland
 Tel.: +41 (0) 52 645 01 01
 Fax: +41 (0) 52 645 01 00
 E-mail: info@metoxit.com

Homepage: www.metoxit.com

Company profile:

METOXIT AG offers a wide range of oxide ceramics. Products are developed and manufactured according to customer specifications. The company's core business are dental products like root posts, implants, abutments, CAD/CAM blanks and instruments as well as BIO-HIP® ceramic ballheads and ceramic inserts for orthopaedics. Precision components include pistons, valves, and wear parts and semifinished rods for milling tools. Available materials include zirconia, alumina Al999, Al998, ZTA ceramic, TZP, TZP-A, ATZ, Ziraldent® and Ziroxit® high-performance ceramic and alumina ceramic. Quality standards to CE-Mark and FDA 510(k) are available. METOXIT quality management is approved to ISO 9001 : 2015, ISO 13485 : 2016 for medical products as well as Annex II of 93/42/EWG.

Production programme:

Material:
 alumina, alumina and platelet reinforced zirconia, cordierite, high purity alumina porous ceramics, partially stabilized zirconia, tetragonal stabilized zirconia, zirconia, zirconia and platelet reinforced alumina, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:
 electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, friction reduction, heat treatment, high temperature applications, household and luxury goods, mechanical and chemical process engineering, medical technology, metal industry, optics, semiconductor industry

Main components: wide range of oxide ceramics development and manufacture

Production plant: after firing machining, assembling, bonding, CIP, cleaning, coating, dry pressing, HIP, isostatic pressing, rapid prototyping, ultrasonic assisted machining, unfired machining, uniaxial pressing, wet pressing

Certificates: ISO 9001 : 2015, ISO 13485 : 2016

Product development partnerships: customers, institutes, user industries, multidisciplinary

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CERAMIC APPLICATIONS

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html

**Company name / Address details:****Morgan Advanced Materials Haldenwanger GmbH**

Teplitzer Str. 27, 84478 Waldkraiburg, Germany

Tel.: +49 (0) 8638 6004 0

Fax: +49 (0) 8638 6004 410

E-mail: info@haldenwanger.de

Homepage: www.morgantechnicalceramics.com/**Ownership:** Morgan Advanced Materials plc**Company profile:**

Since its foundation in 1865, **Morgan Advanced Materials Haldenwanger GmbH** has grown into a world-leading manufacturer of advanced ceramics and specializes in the manufacture of custom made tubes, rollers, and kiln furniture for the thermal processing industry. We also manufacture porcelain laboratory ware. We have a product range made from oxide and non-oxide materials. These are used in applications which fully utilize their thermal, chemical, and mechanical properties. We operate production facilities in Germany, USA, and in China.

Number of employees:

total: 450

in R+D: 20

Production programme:**Material:**

alumina, fused silica, high purity alumina porous ceramics, machinable ceramics, mullite, Mullite bonded SiC, partially stabilized zirconia, silicon carbide, spinel, technical porcelain, zirconia

User industry:

electrical and thermal insulation, energy technology/power generation, environmental technology, friction reduction, heat treatment, high temperature applications, laboratory technology, laser technology, mechanical and chemical process engineering, metal industry, plasma treatment, refractories, semiconductor industry, surface treatment

Production plant:

casting, coating, extrusion, finishing, grinding, hard machining, isostatic pressing, sintering

Certificates:

ISO 9001, DIN 14001, OHSAS 18001

Product development partnerships: customers, user industries**Fair:**

ceramtec, Munich/DE
glastec, Dusseldorf/DE

Part of the technology group**CERAMIC APPLICATIONS****Company name / Address details:****Nishimura Advanced Ceramics Co. Ltd.**

3-2 Kawata Kiyomizudanchi-cho, Yamashina District,

607-8322 Kyoto City, Japan

Tel.: +81 (0) 75 591 1313

Fax: +81 (0) 75 591 4913

E-mail: npc-e3@nishimuraturougou.co.jp

Homepage: nishimuraac.com/**Turnover:** JPY 1000 million**Ownership:** Family**Management:** Yoshihiro Nishimura**Company profile:**

Since its foundation, **Nishimura Advanced Ceramics Co., Ltd. (NAC)** has been developing new materials and new manufacturing methods all the time based on its ceramic manufacturing technologies from over 100 years experience. NAC provides ceramic parts all around the world. 20 % of its sales are coming from overseas exporting. NAC's ceramics are used in EU, USA, GB, Taiwan, Israel, South Korea, and others. As our management philosophy "To Realize a more Affluent Life through the Manufacturing of Products that Satisfy Customers" shows, respective employees of Nishimura Advanced Ceramics try to satisfy our customers through the manufacturing of products, and to meet the accuracy, delivery dates, and costs required by our customers. Based on our over 100-years experience from the foundation of this company, we have inherited traditional techniques and at the same time tried to develop new technologies all the time. We will continue to improve our products to satisfy our customers and to make progress day by day.

Number of employees:

total: 50; in R+D: 3

Production programme:**Material:**

alumina, alumina light reflection, alumina transparent, apatite, coloured zirconia, cordierite, forsterite, heat radiation ceramic, high purity alumina porous ceramics, machinable ceramics, mullite, porcelain, spodumene, steatite, yttria, zircon, zirconia, zirconia HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

automotive, aviation, space travel; electrical and thermal insulation; electronics and sensors; energy technology, power generation; environmental technology; fluid technology; friction-reduction, wear- and corrosion-protection; heat treatment; high temperature applications; laboratory technology; laser technology; mechanical and chemical process engineering; medical technology; metal industry; optics; photovoltaics; plasma treatment; refractories; semiconductor processing equipment

Production plant:

3D measuring, after firing machining, assembling, bonding, ceramic feedstock, CIM, CIP, cleaning, CMM and laser tracker, coating, debinding, digital microscoping, dry pressing, extrusion, fast ceramic production, finishing, green machining, grinding, HIP, isostatic pressing, lapping, polishing, powder processing, pressing, rapid prototyping, sintering, unfired machining, wet pressing

Market leadership: over 100 types of material, special firing know-how, accepting a small order**Special know-how:** firing, material development**Certificates:** ISO 9001 : 2015**Product development partnerships:** customers, institutes, user industries, multidisciplinary**Project funding:** public**Pilot run series:** yes**Part of the technology group****CERAMIC APPLICATIONS****TO BECOME PARTNER OF THE TECHNOLOGY GROUP CERAMIC APPLICATIONS**

PLEASE CONTACT:
c.zepter@goeller-verlag.de

**Company name / Address details:****OECHSLER AG**

Matthias-Oechsler-Strasse 9, 91522 Ansbach, Germany
Tel.: +49 (0) 981 1807 5146
Fax: +49 (0) 981 1807 6700
E-mail: powderinjection@oechsler.com

Homepage:

www.oechsler.com/

Management:

Dr Claudius M. Kozlik, Chairman/CEO;
Christoph Faßhauer, COO; Michael Meyer, CFO

Number of employees:

approximately: 3000

Company profile:**Powder Injection Molding empowers innovation**

OECHSLER was founded in 1864 in Ansbach by Matthias Oechsler and has stepped up to being a full-stack manufacturing partner for high-precision polymer-based solutions ever since. Polymer injection molding paved the way to being a global automotive supplier with the core competencies development, tool making, manufacturing, assembly and testing capabilities.

To offer the full portfolio of injection molding, **OECHSLER** implemented the very innovative engineering technologies of ceramic and metal injection molding into serial production and is now able to translate ideas into solutions made of ceramics and metal. Our PIM products empower innovation and have set standards in the automotive industry, consumer goods and mechanical engineering. Individually developed according to the requirements of our customers, we produce high-quality solutions in series, that combine technology, functionality, and design.

Production programme:**Material:**

alumina, alumina high purity, mullite, powder metal, Si_3N_4 , silicon nitride, tetragonal stabilized zirconia, wear resistant advanced ceramic material, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina/ alumina toughened zirconia ZPTA/APTZ

User industry:

additive manufacturing, aerospace, automotive, CIM, electronics and sensors, fluid handling technology, high temperature applications, household and luxury goods, industrial automation, marine and railway, measuring and testing industry, medical and dental, medical engineering, medical technology, metal industry, OEM, plastic industry, surface treatment, technical ceramics, textile, watch industries

Production plant:

3D measuring, 3D printers, 4"/5" axis machining, after firing machining, assembling, bonding, CIM, debinding, diamond grinding, finishing, grinding, hard machining, lapping, milling, MIM, polishing, rapid prototyping, sintering

Market leadership: ceramic and metal injection molded parts for automotive, medical, textile and sensor etc. applications

Special know-how: high volume production of CIM & MIM decorative parts (interior applications for automotive OEM); grinding, polishing, lapping, laser, tooling; broad material base for ceramic and metal injection molding; inhouse mold design and manufacturing; hybrid parts meaning ceramic + polymer or other combinations for functional integration; high-precision inhouse processes; fully automated technologies including quality monitoring; various post processing solutions

Certificates: IATF 16949, ISO 13485, ISO 9001, ISO 14001, ISO 50001

Fair:

Ceramics Expo, Novi/US
ceramitec, Munich/DE
Hannover Messe, Hannover/DE
Medtec LIVE & T4M, Nuremberg/DE

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CERAMIC APPLICATIONS

**Company name / Address details:****OXIDKERAMIK J. Cardenas GmbH**

Siemensstr. 2, 73095 Albershausen, Germany
Tel.: +49 (0) 7161 9382 0
Fax: +49 (0) 7161 938222
E-mail: info@oxidkeramik.de

Homepage: www.oxidkeramik.de**Ownership:** private**Company profile:**

OXIDKERAMIK J. Cardenas GmbH manufactures components from technical ceramics. The company was founded 50 years ago and is a family business that has a lot of expertise in the manufacturing of ceramics.

Ceramic materials: The ceramic materials produced are a very pure alumina ceramic OK997, direct sintered silicon carbide CARSIC310 and two different types of zirconia qualities, CR105 and CR101. The high-precision ceramic components are used because of their unique mechanical, electrical and thermal properties in many different application areas. Due to the advantages, such as corrosion resistance, wear resistance, electrical and thermal insulation it leads constantly to new applications areas.

Ceramic applications: OXIDKERAMIK J. Cardenas GmbH manufactures pump components for the chemical industry, precision components for the pharmaceutical and food industries, especially where the high corrosion resistance and excellent wear resistance is required. In addition, OXIDKERAMIK J. Cardenas GmbH provides insulating components for electrical applications and special design components for mechanical engineering.

Ceramic production:

OXIDKERAMIK J. Cardenas GmbH produces based on customer specifications and in accordance with their technical requirements. We support our clients in questions of the material, the application and the design. A very high quality is standard; the company is certified according to DIN ISO 9001 : 2008. With the help of a very modern pool of machinery and equipment, especially for hard machining and finishing of ceramic components, OXIDKERAMIK J. Cardenas has specialised in complex shapes with very narrow tolerances and a high surface quality.

Production programme:**Material:**

alumina high purity, direct sintered silicon carbide, zirconia

User industry:

additive manufacturing, aerospace, automotive, CIM, electronics and sensors, fluid handling technology, high temperature applications, household and luxury goods, industrial automation, marine and railway, measuring and testing industry, medical and dental, medical engineering, medical technology, metal industry, OEM, plastic industry, surface treatment, technical ceramics, textile, watch industries

Main components: precision parts, tribological components

Production plant: after firing machining, pressing, sintering, unfired machining

Special know-how: machine components in high precision, customised products, fast ceramic production

Certificates: ISO 9001 : 2015

Product development partnership: customers, institutes, multidisciplinary

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CERAMIC APPLICATIONS

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html

**Company name / Address details:**

Pilot Corporation of America
3855 Regent Blvd, 32224 Jacksonville, USA
Tel.: +1 (904) 645 9999
E-mail: pilotceramics@pilotpen.com

Homepage:
www.pilotceramics.com

Production programme:

Material:
alumina, aluminium nitride, coloured zirconia, high purity alumina porous ceramics, zirconia

User industry:
aerospace, automotive, chemical industry, extrusion, medical technology, optics, technical ceramics

Fair:

Ceramics Expo, Novi/US

NEW

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CERAMIC APPLICATIONS

Company profile:

Pilot Advanced Ceramics manufactures and engineers advanced micro ceramic components for a wide array of worldwide applications from aerospace and automotive to electronics and medical devices. Using proprietary company-developed extrusion, molding and sintering, Pilot Advanced Ceramics are precisely molded using our own engineered molding equipment and sintering know-how. We have a solid reputation as a solutions provider in both new applications and in areas where technical ceramics are already being used. We can quickly find the best way forward for any potential application from prototypes through to full-scale components.

**Company name / Address details:**

Precision Ceramics Ltd
86 Lower Tower Street, Birmingham, B19 3PA, Great Britain
Tel.: +44 (0) 121687 5858
Fax: +44 (0) 121687 5857
E-mail: uk@precision-ceramics.com

Homepage: www.precision-ceramics.co.uk/

Ceramic division(s):
Precision Ceramics USA, St Petersburg, FL 33716, USA, Precision Ceramics EU, Unit 314 Eurobase Park, IDA Industrial Estate, Cork Road Waterford, X91 EH5N Ireland

Ownership: McGeoch Technology Limited

Management: Steve Steve Swallow, Managing Director; Geoff Randle, Business Director; Lee Doherty, Finance Manager; Lucian Falticeanu, Director of Technology; Mick Moore, Sales Manager; Joe Fulton, Production Manager; Prubhjot Singh, Quality Manager Manager

Number of employees:
total: 120; in R+D: 10

Production programme:

Material:
alumina, alumina and platelet reinforced zirconia, alumina nano HIP, alumina zirconia nano HIP, aluminium nitride, boron carbide, boron nitride, machinable ceramics, partially stabilized zirconia, silicon carbide, silicon nitride, zirconia, zirconia nano HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina/ alumina toughened zirconia ZPTA/APTZ

User industry:
aerospace, armour, electrical and thermal insulation, electrical engineering, electronics and sensors, energy technology/ power generation, environmental technology, extrusion, fluid handling technology, food and beverage, friction reduction, high temperature applications, laboratory technology, laser technology, mechanical and chemical process engineering, medical and dental, medical engineering, metal industry, nuclear power generation, optics, scientific instrumentation, semiconductor industry, space and astronomy, space travel, surface treatment, technical ceramics, thermoforming, vacuum technology

Production plant:

4th/5th axis machining, after firing machining, assembling, bonding, CIP, debinding, diamond grinding, dry pressing, extrusion, fast ceramic production, green machining, grinding, hard machining, HIP, isostatic pressing, lapping, laser machining, milling, polishing, pressing, sintering, turning, unfired machining, uniaxial pressing, wet pressing

Market leadership:

Precision Ceramics is a world market leader in the engineering of technical ceramics. We specialise in the design, manufacture and machining of bespoke and advanced technical ceramic components for an ever-widening array of worldwide applications.

Special know-how:

In both new applications and in areas where technical ceramics are already being used, Precision Ceramics has the necessary expertise and specialist in-depth knowledge to quickly find the best way forward for any potential application from prototypes through to full-scale production of components. And once fully up and running, the company can easily take the process one stage further by offering expert advice in the engineering of more demanding materials.

Certificates: BS EN ISO 9001:2015

Product development partnerships: customers, institutes, multidisciplinary

Project funding: public

Project duration: 12 months

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CERAMIC APPLICATIONS

Company profile:

Precision Ceramics is a company dedicated to the engineering of technical ceramics. We specialise in the design, manufacture and machining of bespoke and advanced technical ceramic components for an ever-widening array of worldwide applications. The markets we serve are wide and diverse; from aerospace and automotive through to offshore, oil and gas, electronics and nuclear power generation. All have one factor in common; the quality and reliability of the technical ceramic products we've developed for them. And based on this knowledge – over 20 years of it in fact – our reputation as a solution provider is also well charted and highly respected. In both new applications and in areas where technical ceramics are already being used, Precision Ceramics has the necessary expertise and in-depth knowledge to quickly find the best way forward for any potential application from prototypes through to full-scale production of components. And once fully up and running, the company can easily take the process one stage further by offering expert advice in the engineering of more demanding materials. Precision Ceramics has extensive in-house machining facilities – including 4th and 5th axis machining centres, drilling, grinding, milling, polishing, sawing, tapping, threading and turning – to enable us to manufacture technical ceramic components to the highest specifications. A fully controlled inspection facility with co-ordinated measurement system accurate to 0,02 mm is also in operation to ensure that our rigorous quality standards are maintained at all times. Precision Ceramics specialises in small batches between 1 – 2000 pieces but are quite happy to tender for larger quantities. The company operates to the very highest quality standards and holds BS EN ISO 9001:2015 certification.

**Company name / Address details:****QSIL SE**

Gewerbering 8, 98693 Ilmenau, Germany
Tel.: +49 (0) 3677 6415 0 Fax: +49 (0) 3677 6415 11
E-mail: info@qsil.com

Homepage: www.qsil.com/

Turnover total: > EUR 200 million,
Ceramic Divisions > EUR 40 million

Ownership: private company

Management: Heinz Fabian, CEO;
Michael Keitz, CEO; Erik Neuberger, CFO;
Managing Director QSIL Ingenieurkeramik Andreas Goller;
Managing Director QSIL Ceramics Jaime Schmitt

Number of employees: total: 1000; in R+D: 50

Production programme:**Material:**

alumina, alumina high purity, alumina light reflection, alumina nano HIP, aluminium nitride, BB4C reactionbonded boron arbi-
de, direct-sintered silicon carbide, functional coatings, fused silica, high purity alumina porous ceramics, machinable ceramics, magnesia, molybdenum, partially stabilized zirconia, quartz, RBSiC (silicon-infiltrated reaction-bonded silicon carbide), Si₃N₄, silicon carbide, silicon nitride, spinel, technical porcelain, tungsten, tungsten carbide, wear resistant advanced ceramic material, yttria-stabilised zirconia (3% / 8%), zirconia, zirconia HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina/ alumina toughened zirconia ZPTA/APTZ

Company profile:

QSIL is an innovative, international supplier of high-performance materials, specializing in the production of quartz glass and advanced technical ceramics as well as composite materials. Key markets include the semiconductor, diagnostics, machinery, photovoltaic, light source, medical and other industrial applications in the chemical, analytical and fiber optic industries. QSIL has a globally diversified customer base. Customers include major companies in Europe, Asia and North America. In 2022, the QSIL Group generated sales of more than EUR 200 million with approximately 1000 employees. The QSIL Group includes the companies QSIL GmbH Quarzschmelze Ilmenau, QSIL Nederland B.V., QSIL Ceramics GmbH, QSIL Ingenieurkeramik GmbH and QSIL Metals Hermsdorf GmbH, QSIL Metals Calne Ltd., the headquarters of the QSIL Group is located in Ilmenau, Germany.

User industry:

aerospace, air purification, armour, automotive, automotive: electromobility, aviation, battery, brazing, chemical industry, CIM, coating technology, cutting tools, defense, electrical and electronic industry, electrical and thermal insulation, electrical engineering, electronics and sensors, energy storage, energy technology/power generation, energy transmission, environmental technology, food and beverage, foundry, friction reduction, furnace and kiln manufacturer, healthcare, heat treatment, high temperature applications, high voltage and frequencies applications, industrial, industrial automation, kiln furniture, laser systems, laser technology, lifescience industry, machinery, marine and railway, measuring and testing industry, mechanical and chemical process engineering, medical engineering, medical engineering: implantology, medical technology, metal industry, metallurgy, metrology, nuclear industry, OEM, oil and gas, optics, plasma treatment, processing industry, R&D (universities/institutes/corporate), refractories, roller and needle bearings, semiconductor industry, sensors, Space and astronomy, surface treatment, technical ceramics, thermal engineering, tribology, vacuum technology, watch industries, wear- and corrosion-protection, wind energy, X-ray technology

Production plant:

3D measuring, 4th/5th axis machining, additive manufacturing, after firing machining, assembling, brazing of metal-ceramic assemblies, casting, ceramic feedstock, ceramic-metal assemblies and sub-assemblies, CIM, CIP, cleaning, coating, debinding, diamond grinding, digital microscoping, dry pressing, fast ceramic production, finishing, glazing, grinding, grinding cut-to-size, hard machining, high temperature kilns, HIP, hot pressing, isostatic pressing, lapping, metal working, metallizing, micromachining, milling, polishing, powder processing, precision grinding, pressing, pressing ceramic powder plates and green machining, rapid prototyping, sintering, slip-casting, spraydrying, turning, ultrasonic assisted machining, unfired machining, uniaxial pressing, vacuum brazing, vacuum/gas pressure sintering, white and green body processing

Market leadership: feedthroughs for X-ray tubes, membranes for sensing

Special know-how:

cutting-edge ceramic/metal joining technology
excellent hardness for armour application, wear-resistant ceramic for machinery

Certificates: DIN EN ISO 9001:2015, DIN EN ISO 14001:2015, DIN EN ISO 5001:2018

Product development partnerships: customers, institutes, user industries, multidisciplinary: yes

Project funding: public, industry

Project duration: 24 months

Pilot run series: yes

Fair:

ACHEMA, Frankfurt/DE
Ceramics Expo, Novi/US
ceramtec, Munich/DE
formnext, Frankfurt/DE

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CERAMIC APPLICATIONS

**Company name / Address details:****RATH AG**

Walfischgasse 14, 1015 Vienna, Austria
Tel.: +43 (0) 1513 4427 2110
Fax: +43 (0) 1513 4427 2187
E-mail: info@rath-group.com

Homepage: www.rath-group.com

Turnover total: EUR 100 million

Management: Andreas Pfneiszl, Dipl. Ing. Ingo Gruber

Number of employees: total: 550

Production programme:**User industry:**

battery, dental technology, electrical and thermal insulation, environmental technology, fillers, foundry, furnace and kiln manufacturer, heat treatment, high temperature applications, laboratory technology, oil and gas, photovoltaics, process and production technology, R&D (universities/institutes/corporate), refractories, technical ceramics, thermoforming

Production plant: 3D printers, fast ceramic production, furnace linings/re-linings, green machining

Market leadership: high temperature insulation up to 1800 °C

Special know-how: engineering, construction and customized material (own production)

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry:

Project duration: 48 months

Pilot run series: yes


Company name / Address details:
Paul Rauschert GmbH & Co. KG
Technical Ceramics & Moulded Plastic Parts

Anger 4, 96110 Scheßlitz, Germany
 Tel.: +49 (0) 9265 78 0
 Fax: +49 (0) 9265 7810899
 E-mail: info@rauschert.de

Homepage: www.rauschert.com

Turnover total: EUR approx. 120 million

Ceramic division(s):

Rauschert Heinersdorf-Pressig GmbH
 Rauschert Steinbach GmbH
 Rauschert Kloster Veilsdorf GmbH
 Rauschert k.s. Horni Slavkov
 Rauschert Myslakowice spol. z o.o.
 Rauschert Portuguesa Trajuce Lda
 Rauschert Italia s.r.l. (Muggio)

Company profile:

Rauschert, an independent company with more than 120 years of experience in technical ceramics and plastic components, is a pioneer for innovative industrial solutions. With 1200 employees at 12 production sites worldwide, Rauschert works in close cooperation with scientific institutions to consistently develop new products for applications in various industrial sectors. With the accumulated know-how in both planning and production of new products, competent customer support is available for every step along the process chain.

Ownership: private

Management: R. P. Rauschert, Dr R. Metzler

Number of employees: total: approx. 1200

Production programme:
Material:

alumina, corundum, mullite, steatite, stoneware, technical porcelain, titania, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

additive manufacturing, electronics and sensors, energy technology/power generation, environmental technology, food and beverage, friction reduction, household and luxury goods, mechanical and chemical process engineering, medical technology, textile

Main components:

ceramic coatings, ceramic heaters, valve and pump components, textile ceramics, engineering components, hybrid components ceramic-plastic-metal

Production plant:

assembling, CIM, dry pressing, extrusion, grinding, isostatic pressing, lapping, polishing, rapid prototyping, unfired machining, wet pressing

Market leadership:

insulators and housing for electrical engineering, ceramic components for electrical heating, spark igniters and ceramic heating elements, components for textile machineries

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: industry, public

Pilot run series: yes

Fair:

analytica, Munich/DE
 ceramitec, Munich/DE
 Ceramics Expo, Novi/US
 MedtecLive & T4M, Stuttgart/DE

Part of the technology group

CERAMIC APPLICATIONS


Company name / Address details:
Fa. Rösler CeramInno GmbH

Langenauer Strasse 2, 96355 Tettau-Schauberg, Germany
 Tel.: +49 (0) 926978 130
 E-mail: roesler@roesler-ceraminno.de

Homepage: www.roesler-ceraminno.de

Number of employees: total: 80; in R+D: 4

Production programme:
Material:

alumina, alumina high purity, aluminium titanate, carbides, ceramic oxide powders, glass ceramics, graphite, high purity alumina porous ceramics, lithium disilicate, porcelain, refractory borides, silicon carbide, spinel, zirconia

User industry:

additive manufacturing; automotive; automotive: electromobility; battery; ceramic industry; chemical industry; electrical and electronic industry; energy storage; environmental technology; extrusion; food and beverage; heat treatment; high temperature applications; industrial; kiln furniture; laser systems; mechanical and chemical process engineering; R&D (universities/institutes/corporate); surface treatment; technical ceramics

Production plant: calcination, coating, debinding, dry pressing, extrusion, glazing, grinding, high temperature kilns, kilns, metallizing, polishing, sintering, slip casting, spraydrying, wet pressing

Special know-how: thermal treatment of bulks and components

Certificates: ISO 9001

Product development partnerships: customers, institutes

Project funding: public, industry:

Project duration: 2–3 years

Pilot run series: yes

Fair:

ACHEMA, Frankfurt/DE
 ceramitec, Munich/DE
 POWTECH, Nuremberg/DE
 SOLIDS, Dortmund/DE

Part of the technology group

CERAMIC APPLICATIONS

NEW

Company profile:

Fa. Rösler CeramInno GmbH is a medium sized company that combines innovation and experience. With its 70-year passion for ceramics, we develop new solutions in the fields of technical ceramics and porcelain. In addition, we are the competent and qualitatively reliable partner for the thermal process treatment of all types of bulk goods and other ceramic shaped bodies (up to 1600 °C).

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html

**Company name / Address details:****Saint-Gobain PERFORMANCE CERAMICS & REFRACTORIES****Saint-Gobain IndustrieKeramik Rödental GmbH**

Oeslauer Str. 35, 96472 Rödental, Germany

Tel.: +49 (0) 9563 724 0

Fax: +49 (0) 9563 724 206

E-mail: iCeramics.Refractories@saint-gobain.com

Homepage:

www.ceramicsrefractories.saint-gobain.com

Ownership: Compagnie de Saint-Gobain**Management:** Brigitte Wirth**Production programme:****Material:**

alumina, alumina high purity, BB,C reaction-bonded boron carbide, boron carbide, boron nitride, corundum, direct-sintered silicon carbide, fused silica, mullite, Mullite bonded SiC, partially stabilized zirconia, SiAlON, silicon carbide, silicon nitride, Sintered silicon carbide, wear resistant advanced ceramic material, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina/ alumina toughened zirconia ZPTA/APTZ

Company profile:

Saint-Gobain PERFORMANCE CERAMICS & REFRACTORIES leads the industry in design, development and production of engineered ceramics and refractory products for extreme operating conditions and high temperature applications. Every product and material is designed to maximize performance and durability while minimizing environmental impact. Our ability to deliver custom-made solutions for every application is further enhanced by our R&D centres, manufacturing plants, sales and application engineering specialists who are positioned strategically across the globe. Saint-Gobain is an international business group located in 76 countries. It is one of the 100 largest industrial companies in the world and has a leading position in all its strategic business areas.

User industry:

additive manufacturing, aerospace, armour, automotive, automotive: electromobility, automotive: electronic circuits, automotive: exhaust train, automotive: flowcontrol, battery, chemical industry, chemicals: tablet production, coating technology, dental technology, electrical and electronic industry, electrical and thermal insulation, electrical engineering, electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, food and beverage, foundry, friction reduction, furnace and kiln manufacturer, heat treatment, high temperature applications, kiln furniture, laboratory technology, lifescience industry, measuring and testing industry, mechanical and chemical process engineering, metal industry, metrology, non-ferrous metallurgy, nuclear industry, nuclear power generation, OEM, oil and gas, optics, plasma treatment, power generation, process and production technology, processing industry, R&D (universities/institutes/corporate), refractories, roller and needle bearings, semiconductor industry, space and astronomy, space travel, technical ceramics, watch industries, wear- and corrosion-protection

Production plant:

3D measuring, 3D printers, 4th/5th axis machining, after fir-ing machining, assembling, bonding, casting, coating, debinding, diamond grinding, dry pressing, extrusion, fast ceramic production, finishing, furnace linings/re-linings, green machining, grinding, grinding cut-to-size, hard machining, high temperature kilns, HIP, hot pressing, isostatic pressing, kilns, mold making, powder processing, pre-firing machining, pressing, rapid prototyping, sintering, unfired machining, uniaxial pressing, vacuum forming production, vacuum/gas pressure sintering

Certificates:

ISO 9001 : 2015, ISO 14001 : 2015, ISO 45001 : 2018, ISO 50001 : 2018

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: industry

Pilot run series: yes

Fair:

ACHEMA, Frankfurt/DE
ceramitec, Munich/DE
Ceramics Expo, Novi/US
Wire & Tube, Dusseldorf/DE

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****Saphirwerk AG**

Erlenstrasse 36, 2555 Brugg/Biel, Switzerland

Tel.: +41 (0) 32 374 25 85

Fax: +41 (0) 32 374 25 99

E-mail: info@saphirwerk.com

Homepage: saphirwerk.com/

Ownership: AGZ Holding, Horw, Switzerland

Number of employees:

total: 75; in R+D: 4

Production programme:**User industry:**

armour, brazing, electrical and thermal insulation, electronics and sensors, environmental technology, fluid handling technology, food and beverage, friction reduction, high temperature applications, household and luxury goods, laboratory technology, mechanical and chemical process engineering, medical technology, metal industry, metrology, OEM, oil and gas, optics, R&D (universities/institutes/corporate), semiconductor industry, technical ceramics, watch industries

Production plant:

3D-measuring, assembling, brazing of metal-ceramic assemblies, cleaning, diamond grinding, digital microscoping, grinding, grinding cut-to-size, hard machining, lapping, micromachining, polishing

Market leadership:

precision balls, styles, arifacts for calibration, check valves, pistons, watch parts in sapphire; cartridges (single and double seats); micro dosing systems

Special know-how:

high-precision balls in different ceramics, high-precision pistons, cylinders, valves

Certificates:

ISO 9001-2015; ISO 17025

Product development partnerships: institutes, multidisciplinary

Part of the technology group

CERAMIC APPLICATIONS

TO BECOME PARTNER OF THE TECHNOLOGY GROUP CERAMIC APPLICATIONS

PLEASE CONTACT:
c.zepter@goeller-verlag.de

**Company name / Address details:****SCERAM advanced ceramics**

Zac des carrés du Parc, 10 Rue des Roséristes,
69410 Champagne an Mont d'Or, France
Tel.: +33 (0) 478 3083 64
Fax: +33 (0) 478 2863 68
E-mail: contact@sceram.com

Homepage: www.sceram.com/

Number of employees: total: 10–15; in R+D: 3

Production programme:**Material:**

alumina high purity, aluminum oxynitride AlON, BB₂C reaction bonded boron carbide, boron nitride, cordierite, corundum, direct-sintered silicon carbide, fused silica, high purity alumina porous ceramics, machinable ceramics, mullite, Mullite bonded SiC, partially stabilized zirconia, quartz, silicon, silicon carbide, silicon nitride, spinel, steatite, technical porcelain, tetragonal stabilized zirconia, tungsten carbide, zirconia, zirconia HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

Company profile:

SCERAM advanced ceramics is a family business since 1984, specialising in precision machining of technical ceramics. Established since 1984 in the heart of the Auvergne-Rhône-Alpes region of France, the center of scientific research and industry, SCERAM advanced ceramics has gained expert status in hard materials and the shaping thereof.

User industry:

additive manufacturing, armour, batteries silicon-nitride production, brazing, electrical and thermal insulation, electrical engineering, electronics and sensors, energy technology/power generation, environmental technology, fillers, fluid handling technology, food and beverage, friction reduction, furnace and kiln manufacturer, heat treatment, high temperature applications, kiln furniture, laboratory technology, laser technology, marine and railway, mechanical and chemical process engineering, medical technology, metal industry, OEM, oil and gas, optics, photovoltaics, plasma treatment, plastic industry, R&D (universities/institutes/corporate), refractories, semiconductor industry, technical ceramics, vacuum technology, watch industries

Products:

Standards products : • Tubes for furnaces and pyrometry (ceramic tubes, one-end closed tubes, ceramic tubes with bores, ceramic beads) • Semi-finished products (ceramic discs, ceramic plates, ceramic rods) • Ceramic crucibles (conical high form crucible, conical squat form crucible, cylindrical flat bottom crucible, boats, tubular crucible, incinerating dishes) • Ceramic screws, nuts and washers (flat countersunk screws, pan head screws, pan head gas hole screws, hexagonal head screws, hexagonal socket cap screws, hexagonal nuts, washers) • Ceramic bearing • Ceramic precision balls • Pad printing ceramic rings • Machining to drawing

Production plant:

3D measuring, 4th/5th axis machining, after firing machining, assembling, CIP, cleaning, debinding, diamond grinding, extrusion, fast ceramic production, finishing, grinding, grinding cut-to-size, hard machining, HIP, hot pressing, isostatic pressing, lapping, micromachining, pressing, rapid prototyping, sintering, ultrasonic assisted machining, unfired machining, uniaxial pressing, vacuum/gas pressure sintering

Market leadership:

SCERAM advanced ceramics is a family business specialising in precision machining of technical ceramics. Advanced ceramics are the ideal substitution for conventional materials when their limits of use are reached. Thanks to our "applications/materials" expertise, we guide our customers to the solutions to match their requirements, selecting the suitable material to meet with the specification and always taking the technical requirements laid down by the different production processes on board.

Special know-how:

SCERAM advanced ceramics has full control of the machining of each material it proposes. It has developed a specific machining technic for polycrystalline and monocrystalline ceramics, called the LOW STRESS MACHINING PROCESS® which limits if not eliminates the stresses built up inside the material.

Certificates:

Quality and traceability: SCERAM advanced ceramics is ISO 9001 certified, version 2015, and works exclusively with ISO certified partners and suppliers thereby guaranteeing the quality and traceability of the materials used.

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Pilot run series: yes

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****SCHOTT AG**

Hattenbergstr. 10, 55122 Mainz, Germany
Tel.: +49 (0) 6131 66 3853
E-mail: roberto.perez-castro@schott.com

Homepage: www.schott.com/ceran

Ceramic division(s): SCHOTT NEXTREMA®

Turnover total: EUR 2,2 billion

Company profile:

SCHOTT is a leading international technology group in the areas of specialty glass and glass-ceramics. The company has more than 130 years of outstanding development, materials and technology expertise and offers a broad portfolio of high-quality products and intelligent solutions. SCHOTT is an innovative enabler for many industries, including the home appliance, pharma, electronics, optics, life sciences, automotive and aviation industries. SCHOTT strives to play an important part of everyone's life and is committed to innovation and sustainable success. The parent company, SCHOTT AG, has its headquarters in Mainz (Germany) and is solely owned by the Carl Zeiss Foundation. As a foundation company, SCHOTT assumes special responsibility for its employees, society and the environment.

Number of employees: total: 16 200

Production programme:**Material:**

glass-ceramics

User industry:

additive manufacturing, automotive, aviation, space travel, electrical and thermal insulation, electronics and sensors, energy technology, power generation, environmental technology, food and beverage applications, friction-reduction, wear-and corrosion-protection, heat treatment, high temperature applications, household and luxury goods, laboratory technology, medical technology, optics, photovoltaics, plasma treatment, refractories, semiconductor processing equipment, surface treatment, vacuum technology, display industry

Production plant:

coating, grinding, cut-to-size

Product development partnerships: customers, institutes, user industries, multidisciplinary

Part of the technology group

CERAMIC APPLICATIONS

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html

**Company name / Address details:****SCHUNK Ingenieurkeramik GmbH**

Hanns-Martin-Schleyer-Str. 5, 47877 Willich, Germany
Tel.: +49 (0) 2154 497 113
E-mail: Ceramics@schunk-group.com

Homepage: www.schunk-group.com

Ownership: SCHUNK Group

Company profile:

Schunk Ingenieurkeramik GmbH is an affiliated company of the Schunk Group and belongs to the worldwide leading manufacturers of Technical Ceramics offering a broad spectrum of oxide and non-oxide ceramics for the Strategic Business Areas Ceramic Industry, Burner Technology, Defence, Metallurgy and Mechanical Engineering. Schunk Ingenieurkeramik GmbH is the pioneer with its worldwide class-leading grade IntraSiC® (3D-printed RBSiC). The Schunk Group is an international technology group with approx. 9000 employees in 29 countries. The company is leading supplier of products made of high-tech materials such as carbon, technical ceramics and sintered metals as well as machines and systems from environmental simulation and air conditioning to ultrasonic welding and optical machines.

Management: Managing Directors: Joachim Heym (Chairman), Dr Lars Schnetter

Number of employees: total: 340

Production programme:**Material:**

alumina, BB₂C reactionbonded boron arbid, corundum, high purity alumina porous ceramics, machinable ceramics, mul-lite, Mullite bonded SiC, partially stabilized zirconia, silicon carbide, silicon nitride, zirconia

User industry:

armour, electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, friction reduction, heat treatment, mechanical and chemical process engineering, technical ceramics

Production plant:

extrusion, isostatic pressing

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: industry

Project duration: 1 month – 3 years

Pilot run series: yes

Fair:

ACHEMA, Frankfurt/DE
ceramtec, Munich/DE
Ceramics Japan, Tokyo/JP

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****SCT Ceramics**

Rue du Lotissement industriel, 65460 Bazet, France
Tel.: +33 (0) 562 389 797
E-mail: indsales@sct-ceramics.com /
medsales@sct-ceramics.com

Homepage: www.sct-ceramics.com

Turnover total: approx. EUR 30 million

Ceramic division(s): Industrial Applications Division and Implantable Medical Division

Ownership: Detroyes Industrie

Management: Jean-Paul Detroyes, CEO and President

Number of employees: total: approx. 200; in R+D: 10

Production programme:**Material:**

alumina, alumina high purity, zirconia

User industry:

aerospace, biotechnology, electrical and electronic industry, electrical and thermal insulation, energy technology/power generation, high pressure extrusion, high temperature applications, medical technology, navy, nuclear industry, nuclear power generation, oil and gas, power generation, scientific instrumentation

Main components:

hermetic feedthroughs, connectors, insulators and casings

Products:

custom ceramic-to-metal brazed assemblies: hermetic feed-throughs, connectors, insulators and casings

Production plant:

3D printers, additive manufacturing, after firing machining, assembling, brazing of metal-ceramic assemblies, ceramic-metal assemblies and sub-assemblies, CIP, cleaning, CMM and laser tracker, diamond grinding, dry pressing, green machining, grinding, isostatic pressing, lapping, laser machining, metallizing, micromachining, milling, non-destructive inspecting, pressing, sintering, suspension plasma spraying, uniaxial pressing

Special know-how:

ceramic-to-metal brazing using high purity alumina (Al₂O₃ – 97 % 99,7 % 99,99 %), zirconia (ZrO₂), sapphire and ruby; ALUCER®: proprietary alumina formulas; robust designs for extreme environments (voltage, heat, pressure, corrosion, vacuum, radiation); miniaturized and biocompatible components for implantable devices

Certificates:

ISO 13485, ISO 9001, EN/AS/JISQ 9100; COFREND

Product development partnerships: customers, institutes, user industries, suppliers

Pilot run series: yes

Fair:

Ceramic Expo, Novi/US

Company profile:

SCT Ceramics is a privately held, technical ceramics company specializing in brazed, ceramic-to-metal components for high-reliability markets such as medical, aerospace and energy. Product offerings include hermetic feedthroughs, connectors, insulators and casings. Located in France, SCT Ceramics' vertically integrated site houses R&D labs, engineering and design offices, testing workshops, and can manufacture small to very large product series. SCT Ceramics operates two divisions: The Industrial Applications Division manufactures robust feedthroughs, connectors and insulators for markets such as aerospace, energy and electron tubes. Their Medical Division manufactures biocompatible and miniaturized feedthroughs and casings for cochlear implants, cardiac devices and neurostimulation devices. Products are produced on a custom basis and co-developed alongside clients in order to guarantee product performance in critical applications.

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html



YOUR
TECHNICAL
CERAMICS
PARTNER

Company name / Address details:

Sedal Ceramics (Sedal Group)

C/ De la Quimica, 2-12, 8740 Sant Andreu de la Barca, Spain
Tel.: +34 (0) 93680 3300
Fax: +34 (0) 93680 3303
E-mail: a.campos@sedal.com

Homepage: www.sedalceramics.com

Production programme:

Material:

alumina, alumina high purity, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, food and beverage, mechanical and chemical process engineering, medical technology, OEM, technical ceramics

Production plant:

after firing machining, assembling, dry pressing, finishing, hard machining, hot pressing, lapping, polishing, powder processing, pressing, rapid prototyping, sintering, tape casting

Market leadership:

Sedal Ceramics is the TECHNICAL CERAMICS Division of Sedal Group. The company is focused on the design, manufacture and sale of ceramic components for electronics, energy and automotive, as well as for the industrial machinery, chemical, food industry and sanitary sectors.

Special know-how:

Taking advantage of decades manufacturing experience and as a result of our R&D activity, Sedal Ceramics has developed, in addition to other materials, SEDALOX, our own alumina composition with Nano Shelter Technology, which offers outstanding performance to every single product we manufacture.

Certificates:

ISO 9001/ ISO 14001 / ROHS compliant / REACH compliant / NSF / WRAS approved / KTW

Product development partnerships: customers, institutes, multidisciplinary

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Sedal Ceramics is the TECHNICAL CERAMICS division of Sedal Group. The company is focused on the design, manufacture and sale of ceramic components for electronics, energy and automotive, as well as for the industrial machinery, chemical, food industry and sanitary sectors. It is a worldwide operating ceramic components provider with customers in 4 continents and within its facilities is producing millions of pieces complying with the highest international quality standards. The long term cooperation with companies around the globe is the key of our success, with a strong focus on becoming your preferred partner. Taking advantage of decades manufacturing experience and as a result of our R&D activity, Sedal Ceramics has developed, in addition to other materials, SEDALOX, our own alumina composition with Nano Shelter Technology, which offers outstanding performance to every single product we manufacture. Starting from raw material, our fully integrated manufacturing process and state-of-the-art facilities guarantee the best results to the most demanding customers.



Company name / Address details:

SPT Roth Ltd.

Werkstraße 28, 3250 Lyss, Switzerland
Tel.: +41 (0) 32 387 808 0
Fax: +41 (0) 32 387 8088
E-mail: info-ch@spt.net

Homepage: www.spt.net

Ceramic division(s): Medical, Dental, Industrial

Management: Pierette Glutz

Number of employees: total: 120; in R+D: 15

Production programme:

Material:

alumina, alumina high purity, alumina transparent, EDM machinable ceramic material, machinable ceramics, partially stabilized zirconia, polyruby, tetragonal stabilized zirconia, tungsten carbide, zirconia, zirconia HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina/ alumina toughened zirconia ZPTA/APTZ

User industry:

CIM, dental technology, electrical and thermal insulation, electronics and sensors, fluid handling technology, high temperature applications, laboratory technology, measuring and testing industry, mechanical and chemical process engineering, medical technology, processing industry, R&D (universities/institutes/corporate), semiconductor industry, technical ceramics, textile, watch industries

Production plant:

3D measuring, 4th/5th axis machining, after firing machining, assembling, ceramic feedstock, CIM, debinding, diamond grinding, digital microscoping, fast ceramic production, finishing

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

SPT Roth Ltd. is your specialist for CIM (Ceramic Injection Moulding) products. We combine complex design and high-technical ceramic compound quality for the electronics, medical, machine, and micro technology markets. SPT as a one stop solution supplier provides notable cost reductions for customers without compromising product quality. SPT has pushed the limits of what's possible always further! Capillaries with diameters of 50 µm and boreholes of 15 µm which are used within microchip manufacturing are just two representative success stories among many others. Our knowledge around the CIM process helps us to fabricate parts according to customer needs: • Manufacturing of parts with very complex geometries; • Net shape injection moulding; • Integration of multiple functionalities already in development phase; • Very small parts with extremely narrow tolerances; • High degree of reproducibility. Our philosophy stands for – Experience – Advanced Research & Development – Customer Partnership.

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html

**Company name / Address details:****Steinbach AG**

Westerfeldstraße 32-42, 32758 Detmold, Germany
 Tel.: +49 (0) 5231 9607 73
 Fax: +49 (0) 5231 9607 53
 E-mail: info-tc@steinbach-ag.de

Homepage: www.steinbach-ag.de

Production programme:

Material: alumina

User industry:

additive manufacturing; armour; electrical and thermal insulation; electronics and sensors; high temperature applications; medical technology; process and production technology; processing industry; R&D (universities/institutes/corporate); technical ceramics; wear- and corrosion-protection

Production plant:

3D-measuring, 3D-printers, debinding, digital microscoping, sintering

Special know-how: 3D-printing by LCM (Lithography-based Ceramic Manufacturing) Al_2O_3 and ZrO_2

Certificates: DIN EN ISO 9001 : 2015

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Steinbach: Ceramics in Additive Manufacturing – convincing quality in every detail // Manufacturing highly precise components of impeccable quality in every detail has yet been very expensive and therefore uneconomic. The perfect solution for this problem are slurry based additive processes for Technical Ceramics like the Lithography based Ceramic Manufacturing (LMC). Where conventional methods of manufacturing reach the limit, the Additive Manufacturing of our 3D-Technical Ceramics shows its predominance. Due to the LCM-technology based processing, we can manufacture smallest components in perfect precision impossible to produce in a conventional way. Moreover, the previous generative methods of manufacturing were only restrictedly suitable for prototyping. Due to the LCM-production method, we can manufacture prototypes that meet large-scale production quality standards as well as small and medium-sized series.

**Company name / Address details:****Steka-Werke Technische Keramik GmbH & Co KG**

Griesauweg 35, 6020 Innsbruck, Austria
 Tel.: +43 (0) 512 33402
 Fax: ++43 (0) 512 33402 13
 E-mail: sales@steka.at

Homepage: www.steka.at

Turnover total: EUR 5 million

Ownership: private

Management: Mag. (FH) Markus Dax

Number of employees:

total: 65; in R+D: 3

Production programme:*Material:*

alumina, cordierite, heat radiation ceramic, mullite, porcelain, steatite, technical porcelain

User industry:

automotive, automotive: electromobility, automotive: exhaust train, brazing, electrical and thermal insulation, electrical engineering, electronics and sensors, energy technology/power generation, environmental technology, foundry, furnace and kiln manufacturer, heat treatment, high temperature applications, household and luxury goods, insulated appliances, kiln furniture, laboratory technology, marine and railway, measuring and testing industry, measuring systems: thermal measurements, refractories, technical ceramics, thermal engineering, vacuum technology, welding

Production plant:

after firing machining, assembling, bonding, diamond grinding, dry pressing, extrusion, finishing, furnace linings/re-linings, glazing, green machining, grinding, grinding cut-to-size, hard machining, kilns, lapping, mold making, non-destructive inspecting, polishing, pre-firing machining, pressing, sintering, turning, unfired machining, uniaxial pressing

Market leadership:

Steka is flexible in production and specialized in small- and medium-series production

Special know-how:

strong know-how in ceramic construction and designing methods as well as tool making

Certificates: ISO 9001, ISO 14001, IMDS196101

Product development partnerships: customers, institutes, user industries

Project funding: industry

Pilot run series: yes

Fair:

Hannover Messe, Hannover/DE

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Steka is a medium sized manufacturer for ceramic components primary for electrical applications and is specialized in small- and medium-series production. Based in Innsbruck, Austria, we are a family-owned company with a history going back to the year 1949. Since then we've been gaining a deep know-how in developing products, designing and making tools in our own tool shop. With 65 employees, we supply our ceramics to a growing variety of technical applications. Customers benefit from a strong engagement of our engineering experts when it comes to working out the best solutions in the stage of product development as well as our network of strategic partners covering special requests in the field of technical ceramics. In our production we use two shaping methods: vacuum extrusion and uniaxial powder pressing – we are able to handle very small sizes with just a few gram up to parts of up to 1 kg and more. Steatite and cordierite are the main materials we produce, other materials we can offer on request.

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html

**Company name / Address details:****Techceramic-M JSC**

Techceramic-M JSC, P.O. Box 53, 3100 Mezdra, Bulgaria
 Tel.: +359 (0) 9109 2787
 Fax: +359 (0) 9105623
 E-mail: office@techceramic-m.com

Homepage: www.techceramic-m.com

Ownership: private

Management: Dr Eng. Vasil Hristov

Number of employees:

total: 170, in R+D: 10

Company profile:

Techceramic-M has 30 years of experience in the production of engineering ceramics with a wide range of applications. Used in automotive industry, in household, in electronics, mechanical engineering etc. One of the leaders in manufacturing ceramic components for the aluminium casting processes. With market shares in different continents and many countries. Techceramic-M works in close cooperation with several scientific institutions.

Production programme:**Material:**

alumina, alumina and platelet reinforced zirconia, alumina light reflection, alumina transparent, composites/fibers, cordierite, corundum, fused silica, high purity alumina porous ceramics, machinable ceramics, mullite, partially stabilized zirconia, quartz, silicon, spinel, steatite, yttria-stabilized zirconia suspensions, zircon, zirconia

User industry:

armour, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, household and luxury goods, laboratory technology, mechanical and chemical process engineering, medical technology, metal industry, oil and gas, refractories, surface treatment, textile

Production plant:

after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, casting, ceramic feedstock, CIM, CIP, cleaning, coating, dry pressing, extrusion, fast ceramic production, finishing, glazing, grinding, hard machining, isostatic pressing, lapping, laser machining, micromachining, polishing, powder processing, pressing, sintering, synthesis technology, tape casting, ultrasonic assisted machining, unfired machining, uniaxial pressing, vacuum/gas pressure sintering, wet pressing, white and green body processing

Product development partnerships: customers, institutes, user industries, multidisciplinary

Fair:

ceramitec, Munich/DE

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****TKC – Technische Keramik GmbH**

Ziegelstraße 9, 01662 Meißen, Germany
 Tel.: +49 (0) 3521 718673 0
 Fax: +49 (0) 3521 71867340
 E-mail: post@tkc-keramik.de

Homepage: tkc-keramik.de

Management: Dipl.-Ing. Aaron Makrlík

Number of employees:

total: 26
 in R+D: 4

Company profile:

Since 1996, **TKC – Technische Keramik GmbH** is specialized in the development, manufacture and processing of end-contour-true shape and complex ceramics components. Production takes place from prototype to series applying green machining, ceramic injection molding (LP-CIM, HP-CIM) and pressing. Starting with body preparation, followed by shaping and thermal treatment through to hard machining, the entire process chain is applied for solving customer-specific problems. Besides development and production of ceramics components, assembly production by means of active soldering becomes more and more important. Hot casting (low-pressure injection molding) is the core technology for small-sized components in the small- and medium-scale batch production. TKC has over 40 years experience in this field.

Production programme:**Material:**

alumina, coloured zirconia, cordierite, mullite, partially stabilized zirconia, silicon nitride, steatite, tetragonal stabilized zirconia, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

electrical and thermal insulation, electronics and sensors, energy technology/power generation, high temperature applications, laboratory technology, laser technology, mechanical and chemical process engineering, medical technology, photovoltaics, plasma treatment, semiconductor industry, vacuum technology

Main components:

bearings, implants, heat preader, screws, crucibles, nozzles, wear-resistant parts

Production plant:

after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, CIM, CIP, debinding, dry pressing, fast ceramic production, finishing, grinding, hard machining, isostatic pressing, lapping, polishing, pressing, sintering, unfired machining, uniaxial pressing

Market leadership:

small complex components in small- and medium-scale batch production

Special know-how:

hot casting (low-pressure injection molding), components development

Certificates: ISO 9001 / ISO 13485

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Project duration: different (1–3 years)

Pilot run series: yes

Part of the technology group

CERAMIC APPLICATIONS

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html

3DCERAM

Company name / Address details:

3DCERAM SINTO

4, rue du Parc de Maison Rouge, ZA Maison Rouge,
87270 BONNAC LA COTE, France
Tel.: +33 (0) 55504 1090
E-mail: info@3dceram.com

Homepage:

3dceram.com/de/

Ownership:

Sinto Group, Richard Gaignon and Christophe Chaput

Production programme:

Material:

alumina, aluminium nitride, apatite, cordierite, fused silica, hydroxyapatite, silicon nitride, spinel, tricalcium phosphate, yttria-stabilized zirconia suspensions, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina/ alumina toughened zirconia ZPTA/ APTZ

User industry:

additive manufacturing, aerospace, automotive, dental technology, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, friction reduction, high temperature applications, household and luxury goods, laboratory technology, medical technology, metal industry, nuclear industry, nuclear power generation, oil and gas, optics, plastic industry, space and astronomy, technical ceramics, thermal engineering, wind energy

Products:

Machines: 3D-printers for technical ceramics: C100 LAB for universities and research centers, C100 FAB to develop, qualify and produce short series or small parts, C900 FLEX and C3600 ULTIMATE for big parts and mass customization Materials: alumina; aluminium nitride; cordierite; hydroxyapatite; silica; silicon nitride; tricalcium phosphate; yttria-stabilized zirconia (3 % / 8 %); zirconia toughened alumina/ alumina toughened zirconia ZTA/ATZ; Si₃N₄

User industries: automotive, aviation, space travel; space industry; electrical and thermal insulation; electronics and sensors; energy technology, power generation; environmental technology; friction reduction, wear- and corrosion-protection; high temperature applications; household and luxury goods; laboratory technology; medical technology: dental, orthopaedic, maxillofacial, plastic surgery

Production plant: 3D printers, ceramic feedstock, CIM, cleaning, kilns

Market leadership: additive manufacturing, laser stereolithography applied to ceramics

Special know-how: additive manufacturing, laser stereolithography to technical ceramics

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Pilot run series: yes

EQUIPMENT SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

3DCERAM Sinto offers a complete range of products and services:

- manufacturing of technical ceramics 3D-printed Ceramaker® production line
- manufacturing of on-demand feedstock
- manufacturing of technical ceramics with 3D-printing and services (maintenance, hotline, process improvement, etc.).



Company name / Address details:

6C Tools AG

Industriest. 6, 8305 Dietlikon, Switzerland
Tel.: ++41 (0) 44 512 77 40
E-mail: mail@6c-tools.ch

Company profile:

6C Tools offers a wide range of standardized drilling, milling and threading tools composed of solid Polycrystalline Diamond (PCD). Additional to the broad selection of standard products, 6C Tools offers tailored PCD and PCBN tools for your application. Together with our experts, we can help you finding ways to optimize your production processes. 6C Tools products are optimized for the processing of ceramic materials, such as zirconium oxide, aluminum oxide and silicon nitride. Further application areas are the machining of glass and tungsten carbide.

Homepage: www.6c-tools.ch

Number of employees:

total: 4
in R+D: 2

Product portfolio:

User industry:

cutting tools, dental technology, medical technology, optics, R&D (universities/institutes/corporate), technical ceramics, watch industries

Production plant:

grinding, laser machining, milling

Product development partnerships: customers, institutes

Project funding: public

Fair:

Hannover Messe, Hanover/DE

EQUIPMENT SUPPLIERS

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CERAMIC APPLICATIONS

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E-mail: c.zepter@goeller-verlag.de

**Company name / Address details:****Almatris GmbH**

Lyoner Str. 9, 60528 Frankfurt, Germany
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Fax: +49 (0) 69 957 341 13
E-mail: info@almatris.com

Homepage: www.almatris.com

Turnover total: USD 550 million

Number of employees: total: 1000

Production programme:

Material: alumina, alumina high purity, magnesia, spinel

User industry:

additive manufacturing, armour, battery, CIM, cutting tools, dental technology, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, fillers, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, household and luxury goods, Increased of thermal conductivity in plastics, laser technology, mechanical and chemical process engineering, medical technology, metal industry, optics, photovoltaics, R&D (universities/institutes/corporate), refractories, semiconductor industry, surface treatment, technical ceramics, textile, wind energy

Production plant: calcination, grinding, powder processing, sintering

Market leadership: Excellence and Innovation, driven by Passion. Almatris leads by focusing on quality products, customer service and support, and reliable supply. As devices continually become smaller and soon may be printed at home, energy comes in the re-chargeable kind, and full-time – real-time connectivity is less a trend than a reality, Almatris aluminas enable the development of next-generation technologies. Across our core and emerging markets, Almatris offers the most comprehensive portfolio in the industry, with products that are known to perform consistently, anywhere, anytime, every time.

Special know-how: with more than 100 years of expertise in development, manufacture and supply of premium specialty aluminas and alumina-based products Almatris offers the most comprehensive alumina product portfolio in the industry, including: tabular aluminas, calcined and reactive aluminas, polishing aluminas, calcium aluminate cements, brown sintered alumina, spinels, thermal insulating aggregates and others. Across our core markets – refractories, technical ceramics and polishing – our products are used in a wide variety of industries including ceramic, automotive, polishing and electronics, iron and steel, cement, non-ferrous metals.

Certificates: ISO 9001 / ISO 14001 / ISO 45001 / ISO 50001

Product development partnership: customers, institutes, user industries, multidisciplinary

Fair:

Ceramics Expo, Cleveland/US
ceramitec, Munich/DE

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

For more than 100 years, **Almatris** has refined its expertise in the development, manufacture and supply of alumina and alumina-based materials to become the chosen partner for alumina and high performance solutions. Almatris serves its customers from the largest operational footprint in the industry, with strategically located sales, R&D and manufacturing sites around the world.

**Company name / Address details:****ALTEO**

Usine de Gardanne
Route de Biver, BP 20062, 13541 Gardanne Cedex, France
E-mail: marketing@alteo-alumina.com

Homepage:

www.alteo-alumina.com

Turnover total:

EUR 190 million

Number of employees:

total: 500

Production programme:**Material:**

alumina/aluminium oxide: calcined, low soda, super-ground, high purity, spray dried; aluminium hydroxide

User industry:

armour, automotive, aviation, space travel, electrical and thermal insulation, electronics and sensors, energy technology, power generation, environmental technology, fillers, fluid technology, friction-reduction, wear- and corrosion-protection, high temperature applications, laboratory technology, mechanical and chemical process engineering, metal industry, photovoltaics, refractories, semiconductor processing equipment, surface treatment, textile

Market leadership:

ALTEO is the leading producer of high-value specialty aluminas. Products are destined principally for advanced ceramics, high-performance refractories and fillers & coatings applications.

Special know-how:

high-value specialty aluminas

Certificates:

ISO 9001 for quality
ISO 14001 for environment
ISO 45001 for health and safety
ISO 50001 for energy

Product development partnerships: customers, institutes, user industries, multidisciplinary

Fair:

Indian Ceramics+Ceramics Asia, Ahmedabad/IN
Ceramics Japan, Tokyo/JP
Ceramics Expo, Cleveland/US
Ceramics China, Guangzhou/CN
Asean Ceramics, Bangkok/TH

POWDER SUPPLIERS

Company profile:

From the first Bayer plant created more than 125 years ago, ALTEO has evolved into a leading global supplier of specialty aluminas, providing a unique range of products for many markets such as advanced ceramics, high-performance refractories, fillers and coatings, etc. Located in Gardanne, France, it supplies more than 600 customers around the world. ALTEO provides a comprehensive specialty alumina product range extending from aluminium trihydroxide (ATH) to calcined, low soda and high purity aluminas. To ensure the best quality of products and services, ALTEO continuously invests in the latest production equipment, applied research and technical expertise.

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html



Homepage:
www.arburg.com/en/

Certificates:
ISO 9001 : 2015, ISO 14001 : 2015, ISO 50001 : 2011

Company name / Address details:

ARBURG GmbH + Co KG
Arthur-Hehl-Straße, 72290 Loßburg, Germany
Tel.: +47 (0) 7446-33-3887
Fax: +49 (0) 7446-33-3389
E-mail: pim@arburg.com

Company profile:

ARBURG is one of the world's leading manufacturers of plastic processing machines. The portfolio includes ALLROUNDER injection moulding machines with clamping forces between 125–6500 kN, freeformers for industrial additive manufacturing, robotic systems, customer- and sector-specific turnkey solutions and further peripherals. The PIM range includes especially equipped ALLROUNDER injection molding machines, comprehensive customer support and training courses. ARBURG is a pioneer when it comes to production efficiency, digitalisation (Industry 4.0) and sustainability. All our digital services are combined in the "arburgXworld" customer portal. Environmental protection and the conservation of resources are a permanent feature of the corporate philosophy. Here, "arburgGREENworld" unites all the associated aspects and activities. ARBURG's central aim is for customers to be able to produce their plastic products, from one-off parts to large-volume batches, in optimum quality at minimum unit costs. The target groups include, for example, the automotive and packaging industries, communication and entertainment electronics, medical technology and the white goods sector. An international sales and service network guarantees first-class, local customer support. ARBURG has its own organisations at 34 locations in 26 different countries/ together with its trading partners, it is present in more than 100 countries. The machines are produced exclusively at the parent factory in Lossburg, Germany. From a total of around 3200 employees, around 2650 work in Germany. About 550 further employees work in ARBURG's organisations worldwide. ARBURG has triple certification according to ISO 9001 (quality), ISO 14001 (environment) and ISO 50001 (energy).

EQUIPMENT SUPPLIERS

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CERAMIC APPLICATIONS



Company name / Address details:

CERAMIC POWDER TECHNOLOGY AS
Kvenildmyra 6, 7093 Tiller, Norway
Tel.: +47 (0) 91671322
E-mail: anne@cerpotech.com

Homepage: www.cerpotech.com

Ownership: private

Company profile:

Cerpotech is specialized in the production of advanced ceramic powders for functional materials. Our production capabilities include customized batches for R&D purposes as well as ton-scale supply of powders for industrial production. With our unique production process, we synthesize high quality ceramic powders that are tailored to the specific processing requirements and end-product functionalities of our customers. Thereby, we enable our customers and partners to develop and produce innovative products in many different technology fields. The main applications are:

- electroceramics and piezoceramics in electronics and sensors;
- SOFC/SOEC and membranes in energy technology and power generation;
- catalysts and membranes in environmental technology;
- optical material and transparent ceramics in laser technology and optics;
- many different applications possible in 3D-printing / additive manufacturing;
- materials for batteries.

Management: Anne Dalager Dyrli, CEO

Production programme:

Material: ceramic oxide powders

User industry:

battery, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, laser technology, optics, photovoltaics, R&D (universities/ institutes/ corporate)

Production plant: ceramic feedstock production, powder processing, synthesis technology

Market leadership: customized production of oxide powders

Special know-how: spray pyrolysis technology

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Pilot run series: yes

POWDER SUPPLIERS

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TO BECOME PARTNER OF THE TECHNOLOGY GROUP CERAMIC APPLICATIONS

PLEASE CONTACT:
c.zepter@goeller-verlag.de



Thermoprozessanlagen GmbH

Company name / Address details:

CREMER Thermoprozessanlagen GmbH

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Tel.: +49 (0) 2421 96830-0
Fax: +49 (0) 2421 63735
E-mail: info@cremer-ofenbau.de

Homepage: www.cremer-polyfour.de

Ownership: privately owned

Management: Dr.-Ing. Ingo Cremer, CEO
Dr. Reinhard Schummers, CTO, VP
Dipl.-Ing. Hartmut Weber, International Sales Director, VP

Number of employees: total: 125**Production programme:**

User industry:
furnace and kiln manufacturer, heat treatment, high temperature applications

Production plant: CIP, HIP**Special know-how:**

Thermal process plants for a wide range of processes and process temperatures (400 °C <T< 2500 °C) under various furnace atmospheres (e.g. H₂, O₂, Endo-gas, N₂-mixtures and air). The thermal processes range from the field of powder metallurgy in general (for example CIM, MIM or AM), the production of high performance oxide – or non-oxide ceramic components and special customized applications. Examples: de-binding, sintering, powder reduction, steam treatment, calcination, carburization, carbonization, pyrolysis, HIP, CIP

Certificates: DIN EN ISO 9001**Product development partnerships:** customers, institutes, user industries, suppliers**Project funding:** public, industry**Project duration:** depending on project

Fair:
EURO PM2023, Lisbon/PT

EQUIPMENT SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

CREMER is the world leading manufacturer of furnaces and plants for thermal treatment up to 2500 °C for components and parts, granulates and powders. The portfolio includes MIM Master (Metal Injection Moulding), Ceramic Injection Moulding (CIM), ferrous and non-ferrous powder treatment, high performance ceramics, calcination, debinding, sintering, carburization, carbonisation, pyrolysis and customized engineered processes under various atmospheres (e.g. H₂, O₂, Endogas, N₂-mixtures and air). CREMER is manufacturer of Hot Isostatic Presses (HIP) and Cold Isostatic Presses (CIP) as well as manufacturing lines for Sintering and HIP/CIP for Additive Manufacturing and other processes where non-porous near net-shape parts are required. CREMER stands for Made in Germany, continuity, flexibility and proverbial reliability of a middle size family business with more than 100 employees, high production depth and extensive know-how in plant engineering and process engineering. CREMER provides outstanding 24/7 global customer full-service support out of its own workshop including turnkey installation, commissioning, training classes, spare part service and maintenance.



Extrusion for Ceramic Technology

Company name / Address details:

ECT-KEMA GmbH

Holtendorfer Str. 31, 02829 Schöpstal OT Girsigsdorf,
Germany
Tel.: +49 (0) 3581 878777 0
Fax: +49 (0) 3581 878777 7
E-mail: info@ect-kema.de

Homepage: www.ect-kema.de/

Turnover: EUR 7 million**Management:** Torsten Seidel**Number of employees:** total: 18**Production programme:**

User industry
additive manufacturing, environmental technology, extrusion, high pressure extrusion, laboratory technology, technical ceramics

Production plant:

assembling, ceramic feedstock, extrusion, fast ceramic production, grinding cut-to-size, powder processing, wet pressing

Certificates: ISO 9001 : 2015**Product development partnerships:** customers, institutes, user industries, multidisciplinary**Project funding:** public**Project duration:** 8 months**Pilot run series:** yes

EQUIPMENT SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS



Company name / Address details:

Elkem ASA, Silicon Products

Fiskaaveien 100, 4621 Kristiansand, Norway
Tel.: +47 (0) 3801 7500
Fax: +47 (0) 3801 4970
E-mail: refractories.materials@elkem.com

Homepage: www.elkem.com/

Production programme:

Material:
silicon

User industry:
additive manufacturing, armour, batteries silicon-nitride production, brazing, electrical and thermal insulation, friction reduction, heat treatment, high temperature applications, kiln furniture, metal industry, photovoltaics, plasma treatment, refractories

Production plant:
ceramic feedstock production, powder processing

Product development partnerships: customers, institutes

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Elkem ASA is a world-leading provider of silicones, silicon and carbon-based solutions. We have a unique position in the market with full ownership throughout the value chain, from quartz to specialty silicones. Elkem also has strong positions in specialty foundry alloys and carbon materials. Elkem employs over 6000 people and operates 27 production sites around the globe. The company has an extensive sales and R&D network that enables us to deliver innovative technologies and market-based solutions, while contributing to a sustainable future. Elkem is a signatory to the UN Global Compact, and defines sustainability in line with the principles of the UN Global Compact. Elkem defines sustainability work as continuous efforts to minimise any negative impact on the environment and society. We do this by complying with relevant public regulations, while simultaneously building a profitable and respected business.



Company name / Address details:

EnCeram Chemische Fabrik Budenheim KG
Rheinstrasse 27, 55257 Budenheim, Germany
Tel.: +49 (0) 173 3865481
E-mail: rene.engelke@budenheim.com

Company profile:

EnCeram – The New CIM Binder and Feedstock Provider

EnCeram develops, produces, and distributes proprietary binder systems and feedstocks for the ceramic injection molding process. EnCeram is an internal start-up of the Chemische Fabrik Budenheim. The Chemische Fabrik Budenheim is a specialty chemicals company in the life and material science sector. As part of the family business Geschwister Oetker Group, Budenheim is interested in long-term, sustainable customer partnerships. Being part of the Budenheim Group, EnCeram applies the mindset of a chemical company to ceramic injection molding and leverages Budenheim's specialty chemicals expertise in areas such as polymers and ceramics. Our first products in our portfolio are the binder system EnCeram SW and the related feedstocks with aluminum oxide and zirconium oxide – EnCeram SW AL and EnCeram SW ZR.

Main components:

CIM binders and feedstocks with alumina and zirconia

Production plant: ceramic feedstock, CIM, debinding

Product development partnerships: customers, institutes, user industries

Fair:

ceramitec, Munich/DE

NEW

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS



Company name / Address details:

**ENGINEERED PRESSURE SYSTEMS
INTERNATIONAL N.V.**
Walgoedstraat 19, 9140 Temse, Belgium
Tel.: +32 (0) 3711 2464
Tel.: direct +32 (0) 3710 1982
Fax: +32 (0) 3711 1870
E-mail: maarten.vlaminck@epsi.be

Homepage: epsi-highpressure.com

Ownership: private

Management: Carlo Verbraeken

Number of employees: total: 35

Production programme:

User industry:

armour, electrical and thermal insulation, energy technology/
power generation, friction reduction, heat treatment, high
temperature applications, laboratory technology, laser technol-
ogy, metal industry, oil and gas, optics, refractories

Production plant:

CIP, HIP, in Temse, Belgium; and Haverhill, MA, USA

EQUIPMENT SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS



Company name / Address details:

ESK-SIC GmbH
Günter-Wiebke-Straße 1, 50226 Frechen, Germany
Tel.: +49 (0) 2234 512 162
E-mail: info@esk-sic.com

Company profile:

ESK-SIC supplies customers all over the world. Our speciality and ultrafine grades are in demand around the globe. With our consulting, analyses and tests, we provide a perfect service, playing a key role especially in the development of new products.

Homepage: www.esk-sic.com

Production programme:

Material:

silicon carbide

User industry:

additive manufacturing, armour, electrical and thermal insula-
tion, energy technology/power generation, environmental
technology, fillers, friction reduction, furnace and kiln manuf-
acturer, heat treatment, high temperature applications, insu-
lated appliances, kiln furniture, measuring and testing indus-
try, OEM, optics, photovoltaics, plastic industry, R&D (univer-
sities/institutes/corporate), refractories, semiconductor indus-
try, surface treatment, technical ceramics, textile

Production plant:

ceramic feedstock production, grinding, milling, powder pro-
cessing

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html

**Company name / Address details:****Fraunhofer Institute for Ceramic Technology and Systems IKTS**

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Fax: +49 (0) 351 2553 7600
E-mail: michael.zins@ikts.fraunhofer.de

Homepage: www.ikts.fraunhofer.de

Turnover: EUR 83 million

Management:

Prof. Dr rer. nat. habil. Alexander Michaelis, Institute Director

Number of employees:

total: 800, in R+D: 800

Production programme:

Material: alumina, alumina high purity, alumina transparent, BB₄C reactionbonded boron arbiide, boron carbide, boron nitride, ceramic oxide powders, cermet, composites/fibers, cor-dierite, corundum, direct-sintered silicon carbide, EDM machinable ceramic material, high purity alumina porous ceramics, hydroxyapatite, mullite, partially stabilized zirconia, piezoceramic components, powder metal, Si₃N₄, SiAlON, silicon, silicon carbide, silicon nitride, Sintered silicon carbide, spinel, tetragonal stabilized zirconia, tungsten carbide, wear resistant advanced ceramic material, yttria-stabilized zirconia suspensions, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry: additive manufacturing, aerospace, armour, automotive, battery, brazing, chemical industry, CIM, cutting tools, dental technology, electrical and thermal insulation, electrical engineering, electronics and sensors, energy technology/power generation, environmental technology, fluid handling technology, food and beverage, friction reduction, heat treatment, high temperature applications, household and luxury goods, industrial automation, insulated appliances, kiln furniture, measuring and testing industry, mechanical and chemical process engineering, medical and dental, medical technology, metal industry, nuclear industry, oil and gas, optics, photovoltaics, plastic industry, power generation, processing industry, R&D (universities/institutes/corporate), semiconductor industry, surface treatment, technical ceramics, textile, watch industries, wear- and corrosion-protection, wind energy

Production plant: 3D printers, 4th/5th axis machining, additive manufacturing, after firing machining, assembling, bonding, brazing of metal-ceramic assemblies, casting, ceramic feedstock, CIM, CIP, coating, debinding, dry pressing, extrusion, fast ceramic production, finishing, glazing, green machining, grinding, hard machining, high temperature kilns, HIP, hot pressing, isostatic pressing, lapping, metallizing, milling, non-destructive inspecting, powder processing, pressing, rapid prototyping, sintering, suspension plasma spraying, synthesis technology, tape casting, uniaxial pressing, vacuum/gas pressure sintering, wet pressing, white and green body processing

Certificates: DIN EN ISO 9001, DIN EN ISO 14001, EN ISO 13485, DIN EN ISO / IEC 17025

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Pilot run series: yes

INSTITUTES

Part of the technology group

CERAMIC APPLICATIONS

Company profile:**Fraunhofer IKTS – The Partner for the Development of Single Prototypes and Pilot Production**

The Fraunhofer Institute for Ceramic Technologies and Systems IKTS covers the field of advanced ceramics from basic preliminary research through to the entire range of applications. Superbly equipped laboratories and technical facilities covering 30 000 m² of useable space have been set up for this purpose at the sites in Dresden and Hermsdorf. Based on comprehensive materials expertise in advanced ceramic materials, the development work covers the entire value chain, all the way to prototype production and system integration.

For any class of ceramic materials, Fraunhofer IKTS has access to all the standard processes such as powder preparation, forming, heat treatment and finishing. In functional ceramics, it holds a particular core competency in paste and tape casting technology. Furthermore, Fraunhofer IKTS is able to transfer developments from lab to pilot scale. Industrially suited equipment is available for partners and customers, in order to realize prototypes and pilot-production series for market launch, to optimize production processes, or to implement quality assurance processes.

In addition, Fraunhofer IKTS has decades of experience in the non-destructive testing of components and systems. With the latest measuring technologies, automation concepts and approaches for the interpretation of complex data sets, it offers solutions for quality control and condition monitoring – from sensors to complete user-adapted systems.

In order to demonstrate and qualify ceramic technologies and components as well as non-destructive test methods for new product ideas or industries, Fraunhofer IKTS operates in different market-oriented divisions: Mechanical and Automotive Engineering, Electronics and Microsystems, Energy, Water, Environmental and Process Engineering, Bio- and Medical Technology as well as Non-Destructive Testing and Monitoring. In the cross-sectional divisions of Materials and Processes as well as Material and Process Analysis, established and new technologies are continuously being further developed as “enabling technologies” for all other fields. The focus is on the challenges facing society, e.g. in the field of mobility, circular economy or digital production.

**Company name / Address details:****FREY & Co. GmbH
SYSTEMS FOR POWDER METALLURGY**

Papyrerstr. 12, Lenggries-Fleck, Germany
Tel.: +49 (0) 8042 9176 0
Fax: +49 (0) 8042 9176 51
E-mail: info@frey-systeme.de

Homepage: frey-systeme.de/

Turnover: EUR 7–8 million

Ownership: private

Management: Dieter Lauber, Christine Rieger, Andreas Sonntag

Number of employees: total: 38

Production programme:

User industry: automotive, automotive: electromobility, battery, dental technology, electrical engineering, electronics and sensors, mechanical and chemical process engineering, medical technology, metal industry, technical ceramics

Production plant: isostatic pressing, uniaxial pressing

Certificates: ISO 9001 : 2015

Fair:

ceramitec, Munich/DE
formnext, Frankfurt/DE

EQUIPMENT SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html



Company name / Address details:

René Gerber AG

Werkstrasse 35, 3250 Lyss, Switzerland
Tel.: +41 (0) 32 387 88 00
Fax: +41 (0) 32 384 32 85
E-mail: info@gerber-maschinen.ch

Homepage: www.gerber-maschinen.ch/de/Home

Ceramic division(s): Automotive (gears and motors),
Medical, Dental and Textile Industry

Company profile:

The company **René Gerber AG** is your technology leader in brush deburring, edge honing and polishing with 65 years of experience as a task solver in process development and construction of brush deburring machines, edge honing machines and polishing equipment. The Gerber brush polishing machines and deburring systems are used when it is necessary to deburr flat workpieces or workpieces with indentations or pockets with high precision and to round them off in a defined narrow tolerance range. At the same time, the surface roughness is quite significantly improved by the process. This technology is incorporated in a large number of precision components where absolute absence of burrs and undamaged surfaces are a must. The development and construction of brush polishing machines and face polishing machines as well as the corresponding tools such as brushes and pastes for deburring, defined honing and polishing is based on many years of process technology competence and is adapted to the workpiece requirements in cooperation with you. We accompany you from the first workpiece test and system planning to the commissioning and training for your machines. With us, you have a reliable plant and service partner at your side for the entire service life.

Management: Dipl.-Ing. Marc Schori

Number of employees: total: 20

Production programme:

User industry:

coating technology, dental technology, electronics and sensors, medical technology, metal industry, process and production technology

Production plant:

assembling, diamond grinding, finishing, grinding, hard machining, micromachining, polishing

Market leadership:

leading in deburring, honing and polishing processes

Special know-how: Gerber systems enable the machining of workpieces made of hard materials such as CBN, PCD, sapphire, ruby, ceramic, carbide and steel, but also aluminium, brass and plastics. Specially developed machines in modular design enable the machining of flat parts up to rotary tools and turned parts.

Certificates: ISO 9001:2015

Product development partnerships: customers, user industries

Pilot run series: yes

EQUIPMENT SUPPLIERS



Company name / Address details:

IFKB Universität Stuttgart

Allmandring 7b, 70569 Stuttgart, Germany
Tel.: +49 (0) 711 685 68225
E-mail: philipp.ninz@ifkb.uni-stuttgart.de

Homepage:

www.ifkb.uni-stuttgart.de/forschung/keramiken/

Company profile:

The **IFKB – Institute for Manufacturing Technologies of Ceramic Components and Composites** (in German: Institut für Fertigungstechnologie keramischer Bauteile – IFKB) is part of the Engineering Faculty at the University of Stuttgart. We develop solutions for challenges in the fields of high-performance ceramics and surface technology. The Department for High-Performance Ceramics is doing research along the complete process chain of oxide based technical ceramics from powder selection and material preparation to shaping, debinding, sintering and part characterisation for various shaping technologies especially CIM and AM. Therefore, we are able to aimingly and integratively optimise every aspect of manufacturing with regard to the overall goal such as part or process properties often leading us to develop new materials and manufacturing technologies.

Production programme:

Material:

alumina, alumina and platelet reinforced zirconia, alumina high purity, machinable ceramics, tetragonal stabilized zirconia, wear resistant advanced ceramic material, zirconia and platelet reinforced alumina, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

aerospace, automotive, chemical industry, CIM, coating technology, dental technology, electronics and sensors, medical and dental, medical engineering, scientific instrumentation, technical ceramics, wear- and corrosion-protection

Production plant:

additive manufacturing, ceramic feedstock, CIM, debinding; digital microscoping, extrusion, hot pressing, metallizing, powder processing, sintering, suspension plasma spraying, uniaxial pressing

Special know-how: oxide ceramic materials; material and feedstock preparation for CIM, AM (SLA, FFF), and dry pressing; shaping: CIM, AM (SLA, FFF), uniaxial, pressing, hot pressing, SPS sintering; green machining (5-achsis)

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

NEW

INSTITUTES

Part of the technology group

CERAMIC APPLICATIONS



Company name / Address details:

Industriekeramik Hochrhein GmbH

Industriestraße 4, 79793 Wutöschingen, Germany
Tel.: +49 (0) 7746 9210 0
Fax: +49 (0) 7746 9210 99
E-mail: info@ik-hochrhein.com

Homepage:

www.ik-hochrhein.com

Production programme:

Material:

alumina, alumina high purity, boron carbide, CVD SiC, direct-sintered silicon carbide, powder metal, Si₃N₄, silicon carbide, silicon nitride, Sintered silicon carbide, spinel, tungsten carbide, wear resistant advanced ceramic material, zirconia

User industry:

armour, automotive, batteries silicon-nitride production, chemical industry, coating technology, electrical engineering, food and beverage, foundry, furnace and kiln manufacturer, heat treatment, kiln furniture, life science industry, oil and gas, semiconductor industry, surface treatment

Production plant:

ceramic feedstock, grinding, grinding cut-to-size, powder processing, sintering

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Pilot run series: yes

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:****INMATEC Technologies GmbH**

Heerstrassenbenden 10, 53359 Rheinbach, Germany
Tel.: +49 (0) 2226 9087 0
Fax: +49 (0) 2226 9087 10
E-mail: info@inmatec-gmbh.com

Homepage: www.inmatec-gmbh.com

Ownership: GmbH

Management: Dr Moritz v. Witzleben, General Management

Number of employees:
total: 60, in R+D: 7

Production programme:*Material:*

alumina, alumina high purity, alumina transparent, aluminium nitride, aluminium titanate, boron nitride, calcium silicat, cermet, coloured zirconia, ferrites, glass ceramics, hydroxyapatite, magnesia, mullite, partially stabilized zirconia, porcelain, Si₃N₄, silicon carbide, silicon nitride, spinel, steatite, technical porcelain, titania, zirconia, zirconia nano HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

additive manufacturing, aerospace, automotive, automotive: electromobility, automotive: electronic circuits, chemical industry, CIM, cutting tools, dental technology, electrical and electronic industry, electrical and thermal insulation, electrical engineering, electronics and sensors, environmental technology, extrusion, food and beverage, high temperature applications, household and luxury goods, mechanical and chemical process engineering, medical and dental, medical engineering, medical engineering: implantology, medical technology, metal industry, optics, R&D (universities/institutes/corporate), refractories, space travel, surface treatment, technical ceramics, textile, watch industries

Production plant: ceramic feedstock, CIM, debinding, extrusion, finishing, green machining, MIM, powder processing, sintering

Market leadership: feedstock production and development technology oxidic and non-oxidic ceramic powders with optimized shear roll extruders for the ceramic injection moulding process

Certificates: ISO 9001: 2015, annually certified

Product development partnerships: customers, institutes, multidisciplinary

Project funding: public, industry

Project duration: up to 3 years

Fair:

Ceramics Expo, Novi/US
ceramtec, Munich/DE

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

INMATEC Technologies GmbH brings together the attributes of ceramic materials with the benefits of the injection moulding process. The company is the global leader in the development and production of ceramic feedstocks. These enable the production of components made of ceramics by injection moulding. Rigorous quality assurance ensures the consistently superior qualities of the produced feedstocks. INMATEC adapts the properties of the feedstocks to the specific requirements of each application. The company also offers consulting services along the entire value chain - from idea to series production. Customers benefit from bundled knowledge about ceramics and decades of experience with ceramic injection moulding.



**Institut für Anwendungstechnik
Pulvermetallurgie und Keramik
an der RWTH Aachen e.V.**

Company name / Address details:**Institute of Applied Powder Metallurgy and
Ceramics at RWTH Aachen e.V. (IAPK)**

Augustinerbach 4, 52062 Aachen, Germany
Tel.: +49 (0) 241 809 5534
Fax: +49 (0) 241 809 2266
E-mail: info@iapk.rwth-aachen.de

Homepage:

iapk.de/en/institut

Management:

Univ.-Prof. Dr-Ing. C. Broeckmann (Head of Institute)

Number of employees:

total: 12

Project funding: public, industry

INSTITUTES

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Founded by a support association ("Förderverein"), the IAPK is a research institution associated to RWTH focusing on process and application engineering for ceramics and powder metallurgy. Besides doing research in the above areas, the institute offers consulting and other services concerning the manufacturing process - from powder through the produced part: design and simulation, powder preparation and shaping, consolidation by sintering, thermal treatment, component testing under application conditions and component and operational simulation using FEM.

TO BECOME PARTNER OF THE TECHNOLOGY GROUP CERAMIC APPLICATIONS

PLEASE CONTACT:
c.zepter@goeller-verlag.de



Company name / Address details:

KRAHN Ceramics GmbH

Mühlenhagen 35, 20539 Hamburg, Germany
Tel.: +49 (0) 40 32092 210
Fax: +49 (0) 40 32092 322
E-mail: info@krahn-ceramics.com

Homepage: www.krahn-ceramics.com/de

Production programme:

Material:

2 alumina high purity, alumina transparent, ceramic oxide powders, coloured zirconia, partially stabilized zirconia, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

Company profile:

As an experienced technology partner in the field of ceramics and metal for more than 30 years, **KRAHN Ceramics** accompanies product developers in realizing tomorrow's ideas. And all this along the entire value chain: from ceramic or metal powders to the production of finished parts. As a sparring partner and motivator, the company creates scope for creativity, inspires with new perspectives and transcends borders as well as making the impossible possible.

User industry:

additive manufacturing, automotive, CIM, dental technology, electrical engineering, electronics and sensors, energy technology/power generation, environmental technology, friction reduction, metal industry, plastic industry, processing industry, surface treatment, technical ceramics, textile, thermoforming, watch industries

Production plant:

ceramic feedstock, CIM, debinding, extrusion, finishing, MIM, powder processing, sintering

Special know-how:

The performance spectrum of KRAHN Ceramics includes ceramic and metallic materials and their processing steps. These include powders and binders, preparation and shaping processes, debinding and sintering as well as surface finishing. KRAHN Ceramics can offer customized compounds for the production of ceramic and metal components and is able to produce flexible ceramic and metal filaments for 3D-printing. We develop tailor-made solutions together with our customers.

Product development partnerships: customers, institutes, user industries, multidisciplinary

Pilot run series: yes

Fair:

ceramitec, Munich/DE
Ceramics Expo, Novi/US
K Plastics Trade Fair, Dusseldorf/DE

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS



Company name / Address details:

Lithoz GmbH

Mollardgasse 85a/2/64-69, 1060 Vienna, Austria
Tel.: +43 (0) 1 9346612 200
E-mail: office@lithoz.com

Homepage:

www.lithoz.com

Management:

Dr Johannes Homa, Dr Johannes Benedikt

Production programme:

Material:

alumina, aluminium nitride, cordierite, hydroxyapatite, lithium disilicate, piezoceramic components, silicon nitride, technical porcelain, tricalcium phosphate, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

aerospace, electrical and electronic industry, medical and dental, power generation

Products:

Machines: 3D printers for high-performance and bioresorbable ceramics. CeraFab Multi 2M30, CeraFab S65 Medical, Cerafab 7500 Dental, CeraFab System S65, S230, S25, CeraFab Lab L30

Production plant: additive manufacturing

Market leadership: world leader in additive manufacturing of high-performance

Special know-how: know-how in the whole process chain of additive manufacturing of ceramics. In-house expertise along the whole process chain of additive manufacturing of ceramics. Customer-specific material and machine development and application development

Certificates: EN ISO 9001 : 2015

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Pilot run series: yes

EQUIPMENT SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Lithoz is the world market and technology leader for 3D printers, materials and solutions for the industrial production of high-performance and bioresorbable ceramics. The CeraFab printers are based on the LCM technology, which is the industrial standard technology in high-end markets including aerospace, industrial and medical. The AM systems deliver quality, precision and reliability needed in serial production. Customers can benefit from a variety of outstanding materials ranging from alumina, zirconia, silicon nitride, silica-based for casting-core applications through medical grade bioceramics. Lithoz offers application and material development to customers, as well as powerful software and trainings. Founded in 2011, the company's long-standing expertise has been a decisive success factor for meeting and exceeding market requirements and developing customer-specific product solutions.

FOR TECHNICAL INQUIRIES USE THE CONTACT FORM AT:
www.ceramic-applications.com/knowledge-center/technical-inquiry.html

**Company name / Address details:**

LOOMIS PRODUCTS Kahlefeld GmbH
Stockwiesen 3, 67659 Kaiserslautern, Germany
Tel.: +49 (0) 6301 79999 70
Fax: +49 (0) 6301 79999 92
E-mail: loomisproducts@loomis-gmbh.de

Homepage: www.loomis-gmbh.de

Turnover: EUR 2–5 million

Ownership: private

Company profile:

The goal of **LOOMIS PRODUCTS** is to build the most technically advanced machinery available today, using professionalism, quality and over 105 years of experience, to meet or exceed the expectations and satisfaction of our customers. We have been consistently investing in the development of new technologies and applications. This has led and continues to lead to products that are revolutionary in terms of technology in our market, and is the basis of our success. On 1 August 2022 we have added our new company in Pennsylvania, USA – "LPK - Innovative Solutions LLC".

Management: Pia Ilona Kahlefeld

Number of employees:

total: 15; in R+D: 3

Production programme:*User industry:*

clay industry, dental technology, electrical and thermal insulation, energy technology/power generation, friction reduction, laboratory technology, laser technology, mechanical and chemical process engineering, medical technology, metal industry, oil and gas, optics, plastic industry, refractories, technical ceramics, vacuum technology

Production plant:

assembling, CIP, dry pressing, extrusion, fast ceramic production, grinding, grinding cut-to-size, hard machining, isostatic pressing, powder processing, pressing, uniaxial pressing, vacuum forming production, wet pressing

Market leadership:

vacuum piston extruders, isostatic wet bag presses, isostatic dry bag presses, automatic handling-systems, automation systems, manual assembly stations, fully automatic production and assembly lines, individual product design and manufacture of any specialty equipment requirements

Special know-how:

decompression systems, speed regulated extrusion process, material analysis, isostatic pressing systems, vacuum extrusion systems, filling systems, tool design

Certificates: ASME U3, ISO 9001 : 2015, PED TÜV-Module 2

Product development partnerships: customers, institutes, user industries

EQUIPMENT SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:**

Minchem Ltd.
4, The Old Pottery, GU11 3NB Aldershot, Great Britain
Tel.: +44 (0) 1252 350504
E-mail: enquiries@minchem.co.uk

Homepage: www.minchem.co.uk

Production programme:*Material:*

2 mol alumina and platelet reinforced zirconia, alumina zirconia nano HIP, ceramic oxide powders, cermet, coloured zirconia, functional coatings, partially stabilized zirconia, piezoceramic components, tetragonal stabilized zirconia, wear resistant advanced ceramic material, yttria, yttria-stabilized zirconia suspensions, zircon, zirconia, zirconia and platelet reinforced alumina, zirconia HIP, zirconia nano HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ), zirconia toughened alumina / alumina toughened zirconia ZPTA/APTZ

User industry:

additive manufacturing, armour, automotive, battery, biotechnology, chemical industry, CIM, coating technology, cutting tools, dental technology, electrical and thermal insulation, electrical engineering, electronics and sensors, energy technology/power generation, environmental technology, fillers, food and beverage, foundry, friction reduction, high temperature applications, household and luxury goods, laboratory technology, measuring and testing industry, mechanical and chemical process engineering, medical engineering, medical engineering: implantology, medical technology, metal industry, nuclear industry, nuclear power generation, OEM, oil and gas, optics, processing industry, R&D (universities/institutes/corporate), refractories, semiconductor industry, surface treatment, technical ceramics, textile, watch industries, wear and corrosion-protection

Production plant:

milling, powder processing

Product development partnerships: customers, institutes, user industries, multidisciplinary

Fair:

Ceramics Expo, Novi/US
ceramtec, Munich/DE

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:**

NANOe
6 rue des Frères, 91160 Ballainvilliers, France
Tel.: +33 981 9833 65
Fax: +33 981 7075 52
E-mail: contact@nanoe.com

Homepage: nanoe.com

Production programme:*Material:*

alumina, alumina and platelet reinforced zirconia, alumina high purity, ceramic oxide powders, coloured zirconia, composites/fibers, yttria, yttria-stabilized zirconia suspensions, zirconia, zirconia and platelet reinforced alumina, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

User industry:

additive manufacturing, CIM, fluid handling technology, R&D (universities/institutes/corporate), technical ceramics, textile, watch industries

Production plant:

powder processing, sintering

Special know-how:

high-purity oxide powders manufacturing, spray drying, tailored material development and industrialisation

Certificates:

ISO 9001 : 2015

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

Fair:

formnext, Frankfurt/DE

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS



Fibers for Life.

Company name / Address details:

J. Rettenmaier & Söhne GmbH & Co. KG
Holzmühle 1, 73494 Rosenberg, Germany
Tel.: +49 (0) 7967 152 518
E-mail: info@jrs.de

Homepage: www.jrs.de/jrs_de/

Ownership: family-owned enterprise

Number of employees: total: 3500, in R&D: 100

Company profile:

We, the **JRS, J. RETTENMAIER & SÖHNE Group**, are committed to the research, development and processing of high-quality, functional organic fibers made from renewable, plant-based raw materials. With the innovative JRS organic fiber technology, we make the many functions of these valuable natural substances available to industry. This includes functional products made of cellulose, cereal and fruit fibers or wood fibers, processed as required into ultra-fine fibers, compactates, granules, blends or special dosage forms. As an owner-managed, independent family business group, we have stood for innovation, sustainable prospects, reliability and safety for over 140 years. And we are now in our 4th generation. More than 3500 employees worldwide are involved in the innovative JRS plant fiber technology at over 90 production and sales locations. Problem-solver, systems and technology partner of the industry: Through our functional fibers, we create solutions for many product applications and chemical engineering processes for almost all areas of daily life, such as in pharmacy, food, industry and technology. We rely on the innovative JRS organic fiber technology, our decades of experience and the comprehensive JRS special know-how. Solutions with system and safety - we would be pleased to provide you with detailed advice! The global orientation of JRS makes an optimal procurement of raw materials of the highest possible quality which is an important requirement in order to produce a wide variety of unique products. Our certified advanced production technology stands for top quality, innovative functionality and a perfect price/performance ratio. Caring for the ecological cycle is always a top priority to us. Therefore sustainable plant-based, regrowing raw materials will always be the basis of our product philosophy in the future. Organic cellulose and lignocellulose particles modified for utilization in the ceramic industry. Functions: pore former, rheology agent, reduction of fissures/cracks, moisture stabilisation. You can expect high-class purity combined with constant product performance. Outstanding quality is guaranteed by certified quality control. High variety enables optimal usage. Different structures lead into different effects in your production process as well as for the performance of your final ceramic products. Tailor-made selection of natural particles allows controlled improvement of your application. Available in various sizes and structures: – Long fibers – Cubic particles – Granules – Spheres – Cellulose gels.

Production programme:*User industry:*

additive manufacturing, armour, clay industry, dental technology, electrical and thermal insulation, electronics and sensors, furnace and kiln manufacturer, high temperature applications, kiln furniture, lifescience industry, mechanical and chemical process engineering, medical technology, plastic industry, R&D (universities/institutes/corporate), refractories, technical ceramics, textile

Production plant:

ceramic feedstock, dry pressing, extrusion, fast ceramic production, milling, pressing, sintering, tape casting, uniaxial pressing

Special know-how:

fibers as pore creators and rheology additives

Certificates: PEFC, FSC, DIN EN ISO 9001

Product development partnerships: customers, institutes, user industries

Project funding: public, industry

Project duration:

12 months

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

**Company name / Address details:**

Saint-Gobain ZIRPRO
BP 60025-2539 Rte de Sorgues, 84131 Le Pontet cedex, France
Tel.: +33 (0) 490 3270 71
Fax: +33 (0) 490 3270 61
E-mail: zirpro@saint-gobain.com

Homepage: www.zirblast.zirpro.com/de

Production programme:*Material:*

coloured zirconia, tetragonal stabilized zirconia, zirconia, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

Company profile:

Saint-Gobain ZirPro manufactures zirconium-based beads, powders and grains for a wide variety of industrial applications. Our main product lines include zirconium oxide powders, zirconia-based feedstocks but also ceramic grinding beads, blasting and peening ceramic media and zirconium chemicals. ZirPro build lasting and trusted relationships with its customers by leveraging Saint-Gobain's in-depth innovative materials knowledge, vast technological resources and established worldwide reach and expertise. ZirPro R&D is present in France, China and USA to offer customers worldwide technical support as well as a local presence that drives co-development of solutions to meet unique requirements.

User industry:

additive manufacturing, CIM, dental technology, electronics and sensors, energy technology/power generation, friction reduction, household and luxury goods, R&D (universities/institutes/corporate), refractories, technical ceramics, watch industries

Production plant: ceramic feedstock, powder processing

Market leadership: Saint-Gobain ZirPro is a world-leading manufacturer of zirconium oxide powder solutions. ZirPro offers the largest line of zirconia powders, with composition ranging from monoclinic zirconia, yttria-stabilized zirconia, pigmented zirconia to zirconia-based feedstock for injection molding. ZirPro's line of zirconium oxides solutions addresses the specificities and requirements of many ceramic demanding applications in markets such as aeronautics, automotive, electronics and communications. As technical leader with unparalleled material expertise and market knowledge, ZirPro can recommend the right zirconia for an existing application or partner with customers on co-development for new applications.

Certificates: ISO 9001; ISO 14 001

Product development partnerships: customers, institutes, user industries, multidisciplinary

Project funding: public, industry

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

ASK FOR YOUR INDIVIDUAL OFFER FOR REGISTRATION!

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E-mail: c.zepter@goeller-verlag.de



TOSOH EUROPE B.V.

Company name / Address details:

Tosoh Europe B.V.

Rembrandt Tower, Amstelplein 1, 1096 HA Amsterdam,
The Netherlands
Tel.: +31 (0) 205 6500 10
E-mail: paul.duin@tosoh.com

Homepage: www.tosoh.com

Turnover: USD >6 billion

Number of employees: total: >12 000

Production programme:

Material:

ceramic oxide powders, coloured zirconia, partially stabilized zirconia, tetragonal stabilized zirconia, yttria-stabilized zirconia suspensions, zirconia, zirconia HIP, zirconia nano HIP, zirconia toughened alumina (ZTA) / alumina toughened zirconia (ATZ)

Production plant:

ceramic feedstock, CIM, grinding, powder processing, synthesis technology

Special know-how: Using the latest hydrolyses processes and nano-technologies, Tosoh has created the TZ Series of zirconia powders. Through complete control over materials and production processes, Tosoh can maintain consistent high quality and purity. The TZ Series, the ultimate zirconia powder, delivers added value and product improvements to the customers.

Certificates: ISO 9001; ISO 14001

Product development partnerships: customers, institutes, user industries, multidisciplinary:

Fair:

ceramtec, Munich/DE

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

Company profile:

Tosoh Europe BV is the 100 % affiliate of Tosoh Corporation, a Japanese chemical and specialty products group comprising over 100 companies and over 12 000 people worldwide. Tosoh's commodity and specialty businesses supply manufacturers in numerous markets for making the things making modern life possible. Fine ceramic products from Tosoh's Advanced Materials Division include: pure and yttria-stabilized zirconia powders, zirconia injection molding compounds, colored zirconia, fine beads as well as YTZ grinding and dispersion media. Tosoh is a pioneer in the development of YSZ and has become a major supplier to the world. Earning a solid reputation for consistent high purity and quality that customers can depend on, Tosoh continues to focus resources in R&D and customer services for the ultimate evolution of zirconia.



Company name / Address details:

Treibacher Industrie AG

Auer-von-Welsbach-Str. 1, 9330 Althofen, Austria
Tel.: +43 (0) 4262 505 417
Fax: +43 (0) 4262 5058 417
E-mail: stefan.unterkircher@treibacher.com

Homepage: www.treibacher.com/

Number of employees: total: 750

Production programme:

Material:

ceramic oxide powders, coloured zirconia, partially stabilized zirconia, piezoceramic components, powder metal, tetragonal stabilized zirconia, titanium carbide, tungsten carbide, wear resistant advanced ceramic material, yttria, yttria-stabilized zirconia suspensions, zirconia

User industry:

additive manufacturing, CIM, dental technology, electrical and thermal insulation, electronics and sensors, energy technology/power generation, environmental technology, fillers, friction reduction, high temperature applications, household and luxury goods, mechanical and chemical process engineering, medical technology, metal industry, oil and gas, optics, R&D (universities/institutes/corporate), semiconductor industry, surface treatment, technical ceramics, watch industries

Production plant:

coating, powder processing, suspension plasma spraying, synthesis technology

POWDER SUPPLIERS

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CERAMIC APPLICATIONS



an SKF Group company

Company name / Address details:

VESTA Si Sweden AB

Folkets Husvägen 36, 840 10 Ljungavärk, Sweden
Tel.: +46 (0) 691 32910
E-mail: infoeu@vestasi.com

Homepage: www.vestasi.com

Turnover: EUR 2 million

Ownership: private

Management:

Santhosh Limaye

Number of employees:

total: 13
in R+D: 3

Production programme:

Material:

silicon, silicon nitride

User industry:

armour, batteries silicon-nitride production, energy technology/power generation, friction reduction, high temperature applications, mechanical and chemical process engineering, metal industry

Production plant:

powder processing, synthesis technology

Market leadership:

silicon nitride powders for bearing applications

Special know-how: powder processing

Certificates: ISO 9001 : 2015

Product development partnerships: customers, institutes

Project duration: 12 months

POWDER SUPPLIERS

Part of the technology group

CERAMIC APPLICATIONS

FOR FURTHER DETAILS SEE: www.ceramic-applications.com/applications.html

WASHINGTON MILLS

Company name / Address details:

Washington Mills AS
Sjøbuveien 6, 7300 Orkanger, Norway
Tel.: +47 (0) 72483 501
E-mail: kjullum@washingtonmills.no

Homepage: www.washingtonmills.com

Ownership: private

Company profile:

Washington Mills AS has dedicated itself exclusively to the manufacture of silicon carbide micro grits like, powders and sub-micron powders for a variety of different markets. The company's specialization to silicon carbide has made Washington Mills AS one of the largest and most reputable silicon carbide producers in the world today. Washington Mills AS knows silicon carbide; its intimate knowledge of the product allows it to quickly adjust and respond to its customers' changing needs. Our values are: Expertize, Quality and Reliability.

Number of employees: total: 150; in R+D: 5

Production programme:

Material:
silicon carbide

User industry: additive manufacturing, armour, automotive, automotive: electromobility, electrical and thermal insulation, energy technology/power generation, environmental technology, fillers, friction reduction, high temperature applications, kiln furniture, photovoltaics, plastic industry, R&D (universities/institutes/corporate), refractories, semiconductor industry, surface treatment, technical ceramics

Special know-how: production of silicon carbide micro-grits and sub-micron powders

Certificates: DNV ISO-9001 and ISO 14001

Fair:
ceramtec, Munich/DE

POWDER SUPPLIERS

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CERAMIC APPLICATIONS

XJET

Company name / Address details:

XJet Ltd.
Science Park, 10 Oppenheimer Street, 7670110, Rehovot, Israel
Tel.: +972 (0) 8931 4620
Fax: 972 (0) 8931 4621
E-mail: yael.zhou@xjet3d.com

Homepage:
www.xjet3d.com

Management:
Yair Alcobí – CEO

Company profile:

XJet is a technology company offering revolutionary solutions for the Additive Manufacturing market. The company's groundbreaking NanoParticle Jetting™ technology enables the accurate, scalable, and sustainable production of high-definition 3D metal and ceramic parts. XJet's powderless solution empowers manufacturers to overcome any challenge related to quality, geometric complexities and production volume, supporting and advancing a wide range of industry use cases. The company's print-wash-sinter process is the safest, easiest, most reliable procedure on the market. With over 80 registered patents and a team of industry veterans and R&D experts, XJet is spearheading the next generation of metal and ceramic Additive Manufacturing.

Production programme:

Material:
alumina, alumina high purity, zirconia

User industry: additive manufacturing, aerospace, automotive, ceramic industry, chemical industry, consumer goods, defense, dental technology, electrical and electronic industry, electrical and thermal insulation, electrical engineering, electronics and sensors, environmental technology, faucet and valve discs, healthcare, high temperature applications, high voltage and frequency applications, household and luxury goods, industrial, institutes, instruments and tools, laboratory technology, life science industry, machinery, mechanical and chemical process engineering, medical and dental, medical engineering, medical engineering: implantology, medical technology, metal industry, oil and gas, R&D (universities/institutes/corporate), roller and needle bearings, scientific instrumentation, semiconductor industry, technical ceramics, thermal engineering, valve and energy technology, watch industries

Products:

Machines: Carmel 1400C Zirconia System Carmel 1400C Alumina System Carmel 1400M Stainless Steel System SMART Ceramic Post Processing Station

Production plant: printers, additive manufacturing

Market leadership: Direct Ceramic Material Jetting

Special know-how: NanoParticle Jetting Technology

Project development partnerships: customers, institutes, user industries, multidisciplinary

Fair:
Ceramics Expo, Novi/US
formnext Frankfurt/DE
RAPID+TCT, Chicago/US

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