Within the framework of the project »CerCut« (all-ceramic milling tool with complex geometry) such an end mill was developed from advanced ceramics. By means of this tool, new applications are to be developed in which face milling with ceramic indexable inserts cannot be applied due to geometric limitations. In roughing cutting the nickel-base alloy Inconel 718 with a cutting rate of 750 m/min, the prototype tool met the high expectations. The prototype tool will now be qualified further with industrial partners.

»CerCut« is one of six projects within the Fraunhofer Demonstration Center »AdvanCer« (system solutions with advanced ceramics) that have already been completed.
important advantages as compared to chemically aggressive environments are developed which allows for the coating of cylindrical surfaces of ceramic radial bearings. These bearings, which are used in magnetically coupled, hermetically sealed pumps, are particularly subject to failure in breakdowns, which result in a temporary absence of the medium, or in media with extremely low lubricating effect (e.g. silicon).

In laboratory tests and in the test field of the project partner, it was shown that DLC coatings can compensate the extreme stresses occurring at improper operation, maintaining the operational reliability of the pumps.

Suitable for high loads and without lubrication – crystalline diamond coatings

The extremely high wear and temperature resistance of the diamond coatings in connection with a low friction coefficient also in dry environments allow for their application under extreme pressure-sliding velocity conditions and in dry-running bearings. In current research the project aim is to reduce the roughness of the diamond coatings, and to make them suitable for application in extremely dry inert gases (nitrogen, helium, argon).

The right choice makes the difference

To improve the sliding properties of bearings and face seals in pumps under dry run and mixed lubrication conditions, different coated ceramic components can be used. The aspect reliability and service lifetime are important parameters to be considered as well as their manufacturing costs. In standard face seals, where the price is the decisive factor, an effective improvement of the sliding components may be reached using a cost-efficient graphite coating. For gas seals or medium-loaded lubricated applications the manufacturing of diamond-like carbon coatings should be taken into account. For highest requirements with regard to reliability and service lifetime, crystalline diamond coatings can be used, if the comparatively high manufacturing effort can be accepted.

Effective and efficient – graphite coatings

By means of a special method patented by ESK Ceramics, the surface of a SiC component is converted into graphite by splitting SiC into silicon and carbon. As silicon evaporates at high temperatures, carbon remains at the surface forming a solid layer with a graphite-like structure. This layer significantly stabilizes the sliding behavior under standard conditions, i.e. in aqueous environment, and under moderate pressure and velocity conditions. In a wide range of applications graphite coatings can be used to increase operational reliability.

Diamond – like carbon coatings (DLC)

In gas seals DLC coatings are already successfully used. In this type of seal, the sealing surfaces commonly do not contact each other. However, during run-up and shut-down of the plant solid/soft contacts often occur. In this case, DLC coatings serve to alleviate the effect of short-term contacts of the sliding surfaces and to avoid damage of the seals.

At Fraunhofer IWM a coating technique was developed which allows for the coating of solid/solid contacts of the sliding surfaces and to avoid damage of the seals.

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News

Successful Presentation at Hannover Messe

»AdvancEr« once again showed its research and developments at the booth of TASK GmbH. The trade fair concept to present all ceramic experts in hall 5 has proved successful, as the years before. Aside from the exhibition of the Association of German Manufacturers in the German Industry (VKI), visitors were offered current information and services of products and applications in the field of advanced ceramics in the Ceramics Meeting Point.

ECerS 2007 – Conference of the European Ceramic Society

With a record of 1100 participants, 600 lectures in ten parallel sessions as well as 350 posters, the 10th Conference of the European Ceramic Society (ECerS) took place in Berlin from June 17 to 21, 2007. »AdvancEr« and 20 other institutes and companies participated at the accompanying exhibition at Estrel Convention Center. The annual conference of ECerS takes place every two years. Krakow (Poland) will be the conference venue in 2009.

Within the framework of the conference Prof. Jürgen Heinrich was elected president of the European Ceramic Society. He succeeds Prof. Derek Thompson who has held the office for the past two years. »AdvancEr« congratulates and wishes Prof. Heinrich good success.

Delegation from South Africa Visits Ceramics Meeting Point in Dresden

Within the framework of their journey through Saxony and Saxony-Anhalt the South African representatives stopped also at Fraunhofer IKTS in Dresden. Amongst them were the ministers Malefetsane Koel Maferoka and Phi Makgoe as well as several managing directors of South African enterprises. The delegation visited the Fraunhofer Demonstration Center and pilot plants of IKTS. Thus, the representatives got an insight into the diverse applications and manufacturing methods of advanced ceramics.

The aim of the journey was to get in contact with local companies and research institutes, and to initiate economic relationships.

Fraunhofer Communication Award for IKTS Dresden

At the annual meeting of the Fraunhofer institute directors at the end of March 2007, Katrin Schwarz, responsible for press and public relations at Fraunhofer IKTS, and her Dresden Fraunhofer PR-network, in which all eleven Dresden Fraunhofer institutes participated, was awarded the Fraunhofer Communication Award. In his laudation, the president of the Fraunhofer-Gesellschaft, Prof. Hans-Jörg Bullinger, praised the extraordinary engagement of Katrin Schwarz within the framework of the project »Dresden – City of Science 2006«. Schwarz and the Dresden Fraunhofer PR-network, founded by her already in 2004 supported the project team of the city in numerous public-oriented events. Fraunhofer significantly contributed to the opening ceremony, Day of Technology, Long Night of Science, exhibition »House of the Future« and the closing ceremony (»AdvancEr« reported in issues 2/06 and 3/06).

The engagement of Katrin Schwarz to spark young people's interest for science is particularly to be emphasized. This was underlined by numerous events addressing children and teenagers. Lots of requests of schools, universities and companies for project days and institute tours prove that the efforts pay off. »AdvancEr« congratulates and looks forward to further collaboration!

Current training courses

- Part 3: Construction, quality assurance and application. November 15 and 16, 2007 in Freiburg. Besides a comprehensive introduction we offer two parallel practical sessions in the field of construction/quality assurance and material testing. Starting from 2008 »AdvancEr« offers several courses in German and English:
- Part 1: Introduction into ceramics: Manufacturing technologies, properties, applications. March 12 and 13, 2007 in Dresden
- Part 2: Machining of advanced ceramics. May 6 and 7, 2007 in Berlin

Please find further information at www.advancer.fraunhofer.de

Furthermore, the following advanced training courses of the German Ceramic Society (DKG) will take place at Fraunhofer IKTS in Dresden:
- September 12 to 14, 2007 »Spray drying of ceramic suspensions – technology and statistical test planning«
- October 4 and 5, 2007 »Thermoplastic shape-forming of advanced ceramics – technology and training«

Please find further information at www.dkg.de

- November 14 and 15, 2007 »Ceramic materials for the application in the chemical industry« Fraunhofer IKTS/TASK GmbH, Dresden

Please find further information at www.vdi.de
Success Stories
Piezoceramic Solutions for High-Tech Markets

Everyday life would be unthinkable without piezoceramics. Piezoceramics are used everywhere, i.e. in medicine technology for eye surgery and tartar removal, in telecommunication, semi-conductor or automotive industry, mechanical engineering or aerospace industry. Piezoceramic devices are based on the piezoelectric effect, the interplay of mechanical stress and electrical voltage.

PI Ceramic GmbH Lederhose provides piezoceramic solutions for the full range of applications. The subsidiary of Physik Instrumente (PI) GmbH & Co. KG Karlsruhe, world leader on the sector of highly precise piezoelectric nano positioning systems, was founded in 1992 and can benefit from its 110 years of tradition in the field of manufacturing advanced ceramics. Anyway, the company has already proved its suitability and versatility for numerous applications, ranging from aerospace use, vibration and noise damping to shape-changing structures, from strain gauge applications to dynamic structural health monitoring and energy harvesting.

Comprised of piezo-ceramic fibers, the 1-3 random Fiber Composites provide an outstanding performance for ultrasonic transducers in the frequency range of 50 kHz to 12 MHz. Smart Material uses a proprietary vacuum infiltration process to produce blocks from our proprietary piezo-ceramic fibers. These blocks can be made into efficient piezo 1-3 Composites in various mechanical processes. With the choice of piezo-ceramic volume fractions between 25% up to 80%, the acoustic impedance and other parameters of the 1-3 Fiber Composites can be adjusted in a wide range. Besides ultrasonic applications, 1-3 Fiber Composites have also proved their capability for non-destructive testing, medical and sonar applications. Smart Material GmbH provides advanced piezo composites for commercial applications in large quantities of high quality and low cost.

Smart Materials – Intelligent Composites
Smart Material Corporation and its affiliated company Smart Material GmbH are specialized in the production and development of innovative piezo-composite components: 1-3 Fiber Composites and the Macro Fiber Composites. With the unique Macro Fiber Composites (MFC) technology, licensed by NASA, Smart Material possesses a pioneering actuator technology that has already proved its suitability and versatility for numerous applications, ranging from aerospace use, vibration and noise damping to shape-changing structures, from strain gauge applications to dynamic structural health monitoring and energy harvesting.

On September 27 and 28, 2007 Smart Material GmbH and Fraunhofer IKTS jointly organize the »International Symposium on Piezocomposite Applications ISPA 2007« in the »Gläserne Manufaktur« of the Volkswagen company. The symposium focuses on piezoelectric materials and composites, structural health monitoring, energy harvesting etc. Original papers representing the state-of-the-art, open discussions during the workshop, a poster session and product display at which PI Ceramic GmbH will also participate, will give engineers, designers and researchers the opportunity to exchange ideas. Please find further information at www.ikts.fraunhofer.de.