

Germany

# Successful Symbiosis of Expertise in Plant Engineering and Materials Technology

Component and technology development as well as services for ceramics and powder metallurgy.

In 1982, with **KCE Sondermaschinen GmbH**, the forerunner of the **FCT Group** was founded by *Heinz Kessel* in Rödental, chiefly to supply the ceramics industry with market-ready production plants and process know-how for the new, sophisticated ceramic materials. He brought into the company the technological expertise that he had acquired as a plant engineering specialist at Annawerk (today the Saint-Gobain Group). From the start, the close ties between material know-how, process engineering and mechanical engineering formed the basis for considerations concerning the development of a business strategy. He started off by concentrating on building sintering plants and hot presses, which he already

equipped with on-line measurement techniques to enable provision to be made for material behaviour in plant control. Services, especially in hard machining, rounded off the portfolio at that time. From the machining activities, **FCT Hartbearbeitungs GmbH** evolved, which then also took up the fabrication of components from silicon carbide, with continued success in this to this day. When material scientist *Dr Karl Berroth* joined the company, any gaps in respect of consolidation of the materials know-how were closed. Like plant engineering, the engineering ceramics activities have since developed into an independent company. *Heinz Kessel (HK)* and *Dr Karl Berroth (KB)* spoke to us about developments at the FCT Group,

which today employs 150 people and turned over EUR 32 mill. last year. The FCT Group of companies is now not only the leading manufacturer of hot presses, gas pressure sintering furnaces and vacuum sintering furnaces to elevated temperatures, but also a competent technology partner for plant engineering and development as well as a component manufacturer for a wide range of applications in many sectors of technology. Especially for powder metallurgy and speciality ceramics, spark plasma sintering technology (SPS) has been developed in recent years. In addition to the many laboratory plants, the first production units have advanced this innovative technology worldwide.

*cfi:* In market terms, is it difficult to be a supplier of components and sintering furnaces at the same time?

**HK:** At first glance, yes, because as a plant supplier we run the risk of being regarded as competitors for our customers. In isolated cases, this may be the case. Generally, thanks to this concentrated competence, on the basis of our detailed technological know-how of the process stages prior to sintering, we offer our customers additional expertise that other furnace suppliers cannot provide. Accordingly, with a much broader technical background, we can give performance guarantees.

*cfi:* With the combination of material and process know-how as your mainstays, don't you have greater possibilities for developing innovative processes?

**HK:** Certainly. In our "new plant engineering" at **FCT Systeme GmbH**, we deal exclusively with innovative concepts. Of the 35 people in this unit, 20 % deal exclusively with process engineering

developments. Standardized plants are built by the "old" **FCT Anlagenbau GmbH**, which is now part of the **SYSTEC Group** and in which we only have a minority interest. This ensures that developments ready for series

production can be manufactured at low cost. On the other hand, **FCT-Systeme GmbH** has the necessary scope for innovative sintering systems and novel high-temperature systems.



**Fig. 1**  
High temperature  
vacuum-sintering  
furnace

*cfi: How is FCT Ingenieurkeramik positioned in the market?*

**KB:** We look for niches that don't interest competitors geared to large series manufacturing. Generally, we specialize in high-precision components with complex dimensions, which are either disproportionately large or small in terms of size. With regard to materials, Si<sub>3</sub>N<sub>4</sub>, SiC and C/C-SiC are the key materials. Applications range from metal forming and welding systems, through melting metallurgy to machinery and equipment supply. The applications include metal forming and rolling mill systems as well as chemical and mechanical process engineering or electronics, aerospace systems and wafer handling in the electronics industry. New applications in photovoltaic systems and in alternative energy generation are also tackled. On the basis of the material properties of these materials, generally high-temperature applications and heat technology but also wear and corrosion protection as well as lightweight construction for aerospace can be mentioned.

*cfi: How do you establish new applications?*

**KB:** With regard to new applications, you generally have to consider the hurdle of the necessary sales prices. Non-oxide ceramics usually substitute cheaper materials with a much shorter service life. So we have to sell it to our customers that, although the components to be replaced only cost a fifth or even just a tenth of our prices, our components last 10 to 100 times longer and therefore the cost of maintenance and replacement will be much lower. They often get the

payback on the higher cost price after just a few weeks or months. For this reason, we are more successful at introducing new products that have been developed ready for market rollout in development partnerships with potential customers. In addition to the established high strengths of the materials, in the prototype tests they can also demonstrate their high wear, corrosion and thermal shock resistance. We can only convince customers though if we can document our control of a reliable and economic manufacturing system.

*cfi: What market shifts have resulted for plant engineering in recent years?*

**HK:** Especially the development and introduction of SPS technology has strengthened our position in powder metallurgy. This market sector now averages around 30 % of our sales.

*cfi: You have also supplied plants to the photovoltaic industry. Is this a new sector?*

**HK:** We got involved with direct crystallization because we were prompted to do so by certain requests and in the meantime we have successfully concluded its industrial application: Although plants for the photovoltaic industry currently make up a large part of our sales, they still are not part of our core business.

*cfi: Which general trends have you observed in plant engineering in the last few years?*

**HK:** Software applications have become much more complex because with the increasing requirements for quality and reliability of the sintered components, it has become necessary to measure and analytically process more and more details on-line. A perennially "hot

topic" is of course the energy efficiency of the plants.

*cfi: Precondition for process development is a facility for testing and pilot plant trials. How do you go about this?*

**HK:** We have installed furnaces suitable for production with useful volumes to m<sup>3</sup> ranges to a value of around EUR 4,0 mill. in the FCT Group of companies. These are operated with a wide range of production-oriented conditions and are available for process development – also for potential component and plant customers, and can be used for the specific development of new products.

**KB:** On the engineering ceramics side, we can also supply the process chain before and after the sintering or hot pressing process (this includes slip preparation, granulation, shaping, finishing). Our services even cover the entire process chain, including sintering to 2 400 °C in vacuum, inert gas or gas pressure (alternatively hot pressing or hot isostatic pressing).

It is therefore possible for us to produce, for example, sputtering targets for thin film systems, high-strength composites for wear components, diffusion bonds, materials for indexable inserts, ceramic brake discs and much more under production conditions. Depending on the quantities required by our customers, we can partner them as component suppliers, service providers for prototype- and limited lot manufacturing or as plant supplier. In this respect, materials engineering and plant engineering go well together under one roof.

*cfi: Thank you for talking to us.* KS

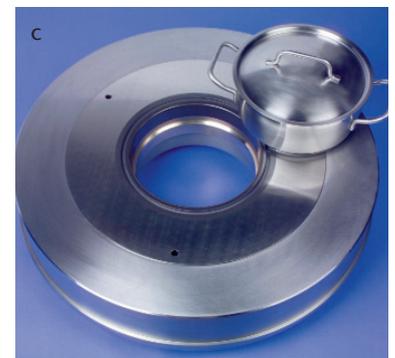
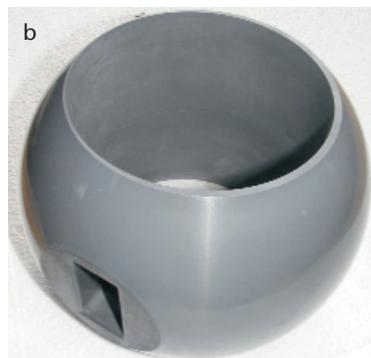
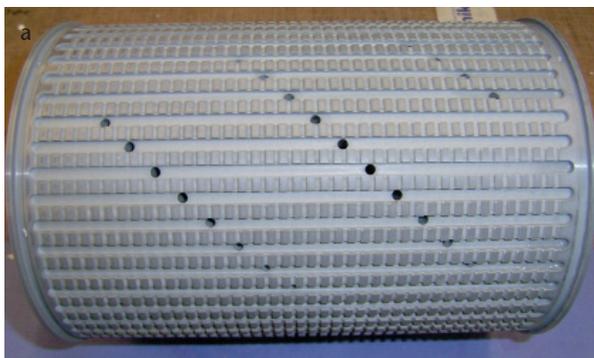


Fig. 2 a-c): a) Drawing cylinder, b) Silicon nitride ball valve, c) Deep-drawing hydroforming cooking pot