Nishimura Advanced Ceramics: A Commitment to Internationalization

Having been a reference point in the domestic market as Nishimura Porcelain Co. Ltd. for several decades, the company became Nishimura Advanced Ceramics in January 2017.

Fig. 1
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The decision to change the name to Nishimura Advanced Ceramics was made in respect of the internationally used standards for technical ceramic components. Porcelain, an expression used since 1967 in the company name, is misleading. It was chosen when some insulator components were based on this material. Today the wide portfolio of technical ceramic components (e.g. alumina and zirconia) needs to be accommodated, and the new name was preferred to the term "fine ceramics" which is used only in Japan. With advanced ceramics, the company aims to underline the sophisticated, wide product range.

History

The company was founded by Masajiro Nishimura in 1918 and started with the manufacture of electromagnetic devices. It was reorganized in 1947 as Nishimura Seitosho Co. Ltd. at Higashiyama district/Kyoto when Yosakichi Nishimura became CEO. In 1967 it was renamed to Nishimura Porcelain Co. Ltd. In 1970 the headquarters and all manufacturing facilities were transferred to Yamashina/Kyoto. In 1981 Yoshio Nishimura took over from his father and headed up the company until he handed over the responsibility to his son Yoshihiro in 2011, who decided together with the management board that it should be renamed Nishimura Advanced Ceramics as the company with its 42 employees aims to strengthen their export business on a global scale.

Keywords
porous ceramics, transparent ceramics

Production and product range

Nowadays the company uses over 100 proprietary formulations based on alumina, zirconia, yttria, aluminium nitride and other materials. All bodies including spray-dried granulates and feedstocks are prepared in-house. CIM and MIM feedstocks are also offered to external customers. The shaping techniques include dry and wet pressing, extrusion, injection moulding, casting and cold isostatic pressing. Green machining can be applied before firing in the temperature range 1300–1700 °C in oxidizing or nitrogen atmosphere using a variety of batch furnaces. As a lot of applications require high surface quality, a wide range of final grinding and polishing machines was set-up. Where needed, surface coating and metallizing can be performed.

The product range includes functional and structural ceramic parts for various user industries e.g. automotive, electrical and thermal insulation, electronics and sensors, energy technology, power generation, environmental technology, friction reduction, wear and corrosion protection, heat treatment, mechanical and chemical process engineering, medical technology, and semiconductor processing. The reference list includes names as Canon, Sumitomo, Panasonic, Sysmex, Ferrotec Ceramics Corporation, Fuji Electric and Mitsubishi Electric Corporation. The following cases studies present two product lines in the wide-ranging product portfolio.

Case studies

Porous ceramics

A range of porous materials based on alumina or alumina/cordierite with average pore sizes of 0,1–10 µm is offered. The ceramic components can be used e.g. as absorption carriers for liquids or separators (oil and water) as well as for gas or liquid

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filtration or carriers for fragrance, germicides etc. They can also be coated with silver colloids or platinum for use in environmental technology.
These "ecological ceramics" include the platinum catalyst Catamic, which oxidizes and decontaminates organically contaminated air and foul odours to create harmless odour-free gas at low temperatures (200–400 °C). The "antibacterial ceramics" against escherichia coli, staphylococcus aureus, etc. are treated with silver colloids to reduce the emergence of bacteria over long periods by "silver ion water sterilization". These products are used for water treatment (sterilization/purification), cooling water and air conditioning. Other types of coated ceramics can be applied for dechlorination, zinc elution, and iron elution.

Translucent alumina

The translucent alumina ceramic has high total light transmittance (>83,7 %) and is made from pure fine-grained 99,99 % alumina (1–3 µm). Owing to the fine crystal size, the surface is extremely smooth. It can substitute sapphire. Applications are e.g.: semiconductor devices, substrates for electric parts, reaction tubes, crucibles, medical equipment and analysers. A special quality of translucent ceramics consists of superfine crystals (0,2–2 µm).

Research and development

Since the company's founding, an R&D cooperation with the KITC (Kyoto Municipal Institute of Industrial Technology and Culture – see page 42), and respectively with the predecessor of this institute a similar concept have been in place. Furthermore, in the laboratory in-house projects and projects in partnership with customers are launched.
As a variety of products is already used in medical devices, the company also aims to serve the needs of medical implants. For this reason, research is now carried out with apatite and apatite nanopowders, as the material shows excellent biocompatibility by offering good ion exchange capacity, absorptivity and optical properties, too.
Another field of research remains in the power device segment.
Great efforts have meanwhile been undertaken in optimising the microstructure of various products (SEM images Fig. 4) as in many applications fine-grained regular structures show competitive advantages to conventional coarser, unregular ones.

Reference

Ceramic Heat Sinks without Aluminium Fins: N-9H Innovative Ceramic Heatsinks. CERAMIC APPLICATIONS **3** (2016) [2] 16–17

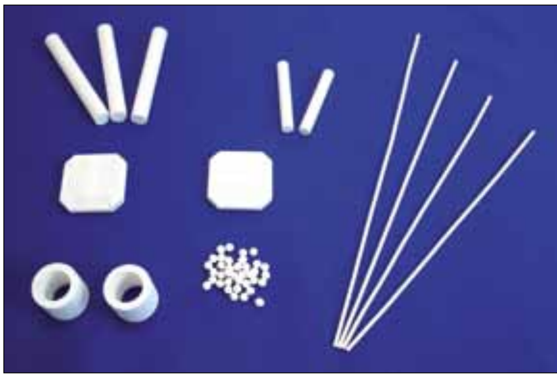

Fig. 2
Porous alumina components

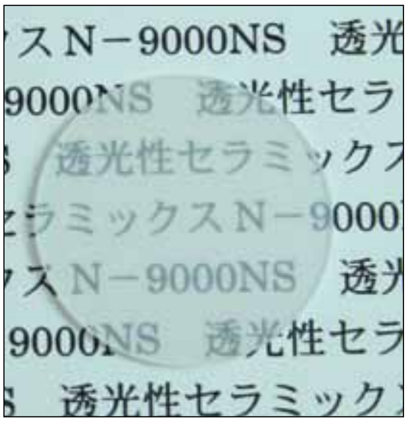

Fig. 3
Transparent ceramics

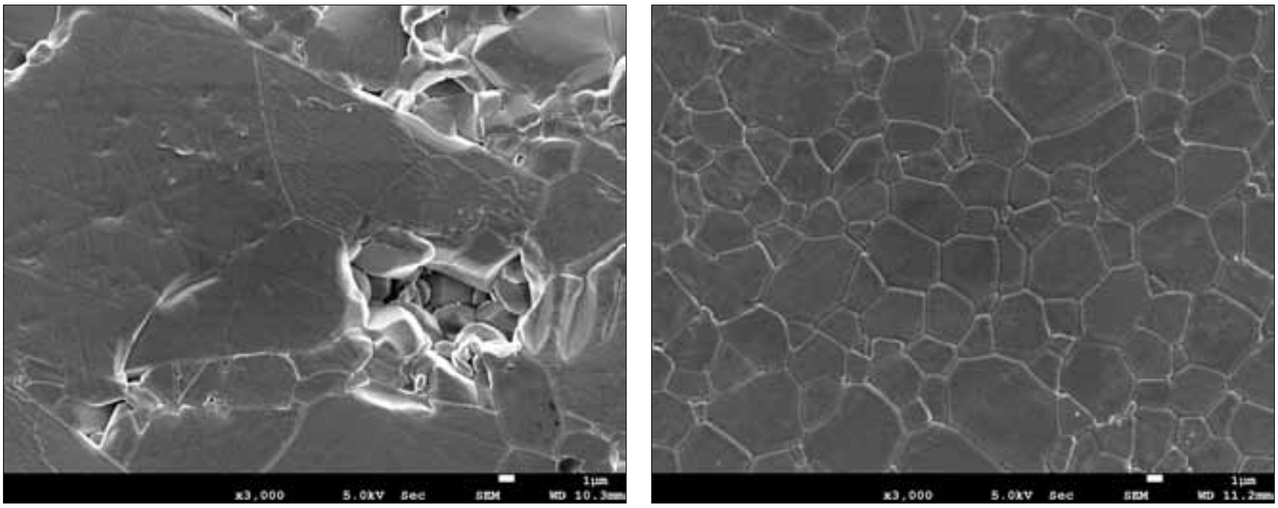

Fig. 4
Microstructure of competitors alumina (l.), and Nishimura product (r.)

KITC:
Kyoto Municipal Institute of Industrial Technology and Culture

The KITC was founded in 1916 and is today located at its new premises in the Kyoto Research Park (KRP), which was opened in 1989. KRP is the only private research park in Japan and aims to become the "Innovation Hub" of Kyoto – being both an academic and industrial city – together with the local government, academia and industry. KRP is the home of more than 350 companies and institutions in various technical areas.

The KITC is exploring advanced technologies and supporting regional business communities to enhance innovation and competitiveness in domestic and export markets. It has nearly 80 employees, of whom 57 are researchers. The mission of KITC is: R&D, testing and analysis services, advice and support of technological issues and the nurturing of a next generation of engineers and craftsmen to support regional SMEs. In the division pottery and fine ceramics, seven researchers are working on topics like ceramic process engineering, material improvement and quality enhancement. The functions of the KITC include technology transfer, joint research projects, research training developing regional human resources for global business and opening up global markets for regional industries.

One example of the networking in research is the Kyoto-area Super Cluster for innovation in SiC power electronics. Power conversion is globally a growing market. Based on first studies in Japan on SiC materials in 1970, research continued until 2002 when the first stage knowledge cluster was established.

Consequent networking in clusters has meanwhile led to mass production of SiC-based power devices for various applications with Rohm Company acting as global industry partner.

Kyoto is the home of many global players like SHIMADZU (since 1875), OMRON (since 1953), Murata (since 1944), HORIBA (since 1945), Rohm (since 1954), KYOCERA (since 1959), Nidec (since 1973), Nintendo (since 1889, the second establishment in 1970) and Samco (since 1979).

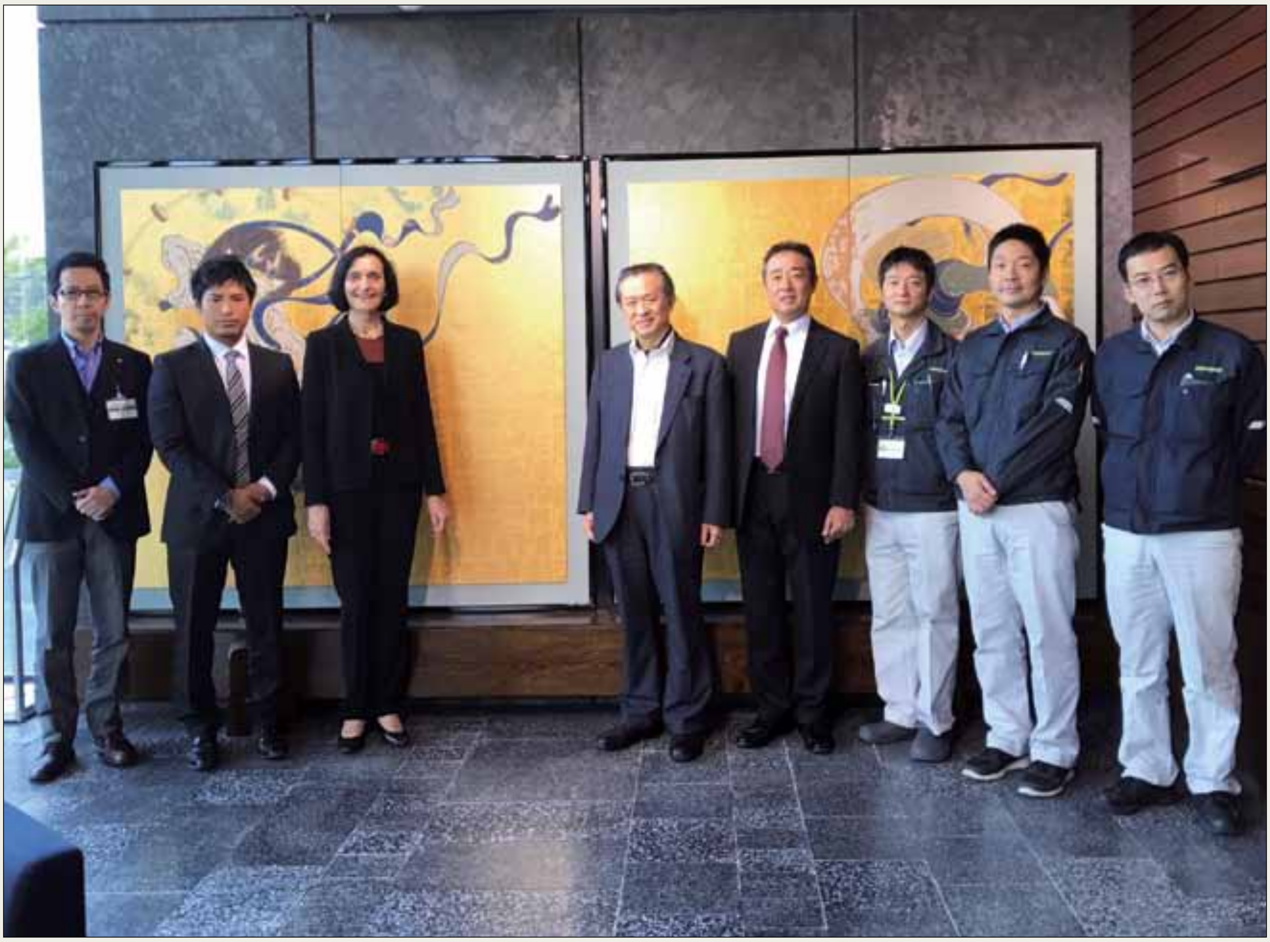

Fig. 5 Tadashi Hayami, Ko Nishimura, Karin Scharrer, Sei-ichi Nishimoto (Chairman of KITC Board), Yoshihiro Nishimura, Taigo Takaishi, Hirofumi Inada, Yuya Arakawa (f.l.t.r.)