

Press Information

Advanced ceramics for the semiconductor industry: high-strength carrier material for probe cards with increased coefficient of thermal expansion

KYOCERA Fineceramics Europe has further developed its innovative high-end ceramic Starceram N3000 P and is launching a new silicon nitride for the functional testing of next-generation microchips.

Kyoto/Esslingen, 24th October 2024. There is currently more than enough demand to justify the expansion of semiconductor production in Europe. As a result, continuous progress is also being made on the development front. The structures of these highly integrated circuits are becoming smaller and more compact every year. The production of AI chips and components for fifth-generation electronic devices, such as 5G smartphones, is particularly demanding. Accordingly, the quality and functional testing of these advanced microchips is equally complex.

The key material: silicon nitride

Before the chips are separated further, they are tested on the silicon wafer. What are known as 'probe cards' guide up to 100,000 fine contact needles and more to the contacts of the microchips, making it possible to test their functionality. A silicon nitride plate is used to guide and insulate the contact pins from each other in the probe card. This fixes the needles at regular intervals of a few tens of micrometres.

Silicon nitride is able to keep these small distances absolutely constant even over the extreme temperature range of between -40 and +200 °C (degrees Celsius) at which the tests are carried out.

The coefficient of thermal expansion of the new material has been specifically increased in comparison to Starceram N3000 P (comparison temperature of +150 °C):

Starceram N3000 P

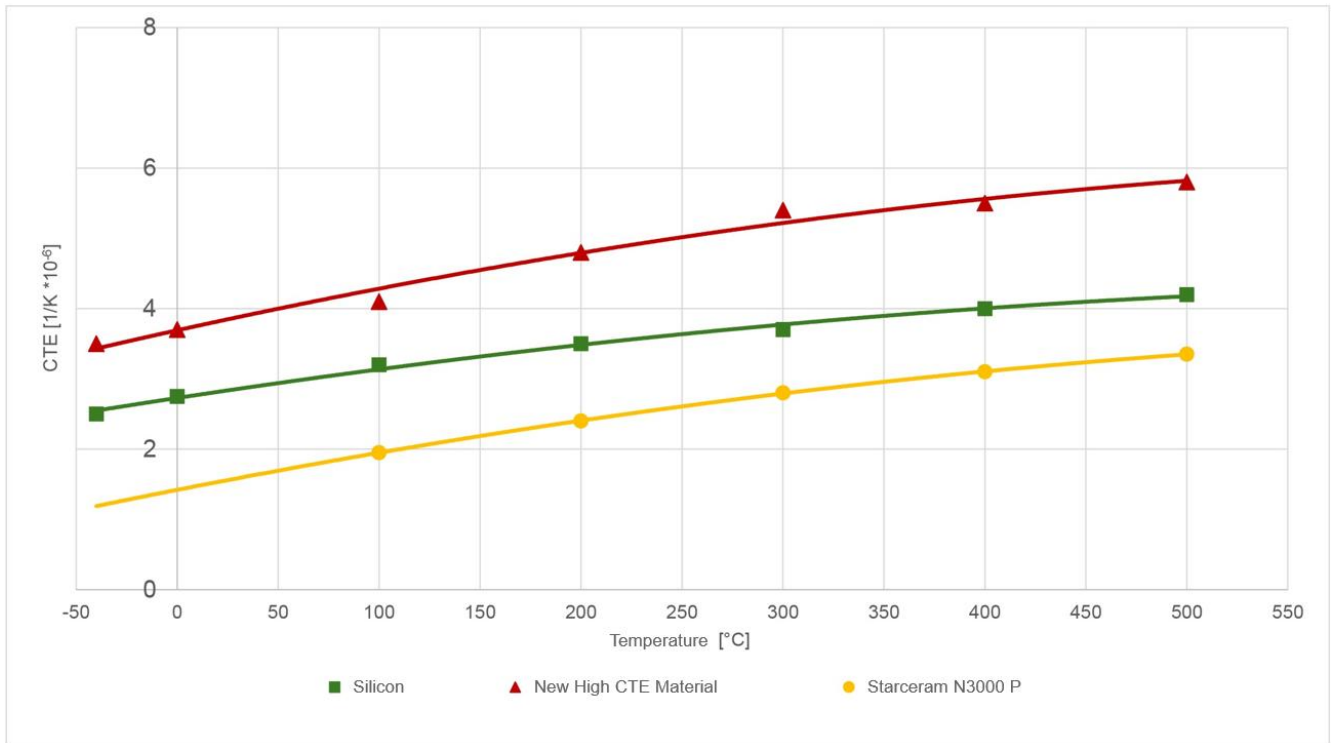
$$\alpha = 2.2 \cdot 10^{-6} \cdot \text{K}^{-1}$$

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Newly developed material

$$\alpha = 4.4 \cdot 10^{-6} \cdot \text{K}^{-1}$$

In addition to the increased coefficient of thermal expansion, the new silicon nitride also has a high flexural strength of > 800 MPa (megapascals). This allows the production of thin silicon nitride plates with very narrow distances between the contact needles. These are important properties, especially when it comes to testing next-generation microchips.



Comparison of temperature-dependent coefficient of thermal expansion (CTE)



Silicon nitride guide plates for probe cards



For more information on Kyocera: uk.kyocera.com

About Kyocera

Kyocera has been successful in Europe for over 50 years. From its European headquarters in Esslingen am Neckar, KYOCERA Europe GmbH operates 27 sites including manufacturing facilities, with products ranging from fine ceramics, electronics, automotive, semiconductor and optical components to industrial tools, LCDs, touch solutions, industrial printing components, solar systems and consumer goods such as kitchen and office products.

Kyocera's high-performance ceramic products are produced and distributed by [KYOCERA Fineceramics Europe GmbH](#), a subsidiary of KYOCERA Europe GmbH. The Kyocera Group is one of the world's leading providers of high-performance ceramic components for the technology industry, offering over 200 different ceramic materials, as well as state-of-the-art technologies and services tailored to the specific needs of each market.

KYOCERA Europe GmbH is a company of the KYOCERA Corporation headquartered in Kyoto/Japan, a world leader in semiconductor, industrial and automotive components as well as electronic components, printing and multifunction systems, and communications technology. The technology group is one of the world's most experienced manufacturers of smart energy systems, with more than 45 years of industry expertise. The Kyocera Group comprises 292 subsidiaries (31 March 2024). In England, Kyocera has a subsidiary in Frimley, KYOCERA Fineceramics Ltd. With around 79,200 employees, Kyocera generated net annual sales of around EUR 12.29 billion in the 2023/2024 fiscal year.

Kyocera is ranked 672 on Forbes magazine's 'Global 2000' list for 2023, and ranked as 'The 100 Most Sustainably Managed Companies in the World' according to the Wall Street Journal. For the second year in a row, Kyocera qualified for the Dow Jones Sustainability Index (Asia-Pacific). As well, Kyocera receives a Gold rating on EcoVadis Sustainability Survey for the second consecutive year and was acknowledged as a 'Top 100 Global Innovator 2023', being one of the world's leading innovators, for the eighth time by Clarivate.

The company also takes an active interest in cultural affairs. The Kyoto Prize, a prominent international award, is presented each year by the Inamori Foundation — established by Kyocera founder Dr Kazuo Inamori — to individuals worldwide who have contributed significantly to the scientific, cultural, and spiritual betterment of humankind (equivalent to approximately €596,500 per prize category).

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