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AIST GROUP

NGK INSULATORS

PRESS RELEASE

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AIST Group
NGK INSULATORS, LTD.

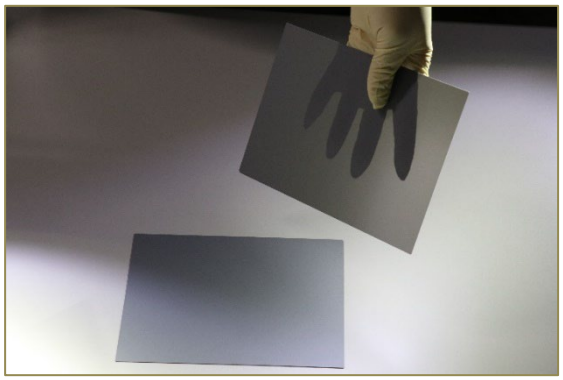
Initiation of Joint Research for Achieving High Accuracy in Evaluating Thermal Diffusivity of Silicon Nitride Ceramic Substrates

- The AIST Group (consisting of National Institute of Advanced Industrial Science and Technology (AIST) and AIST Solutions Co.) and NGK INSULATORS, LTD. (NGK) have embarked on joint research regarding validating methods for evaluating thermal diffusivity of silicon nitride ceramic substrates used for power semiconductor components (power semiconductor modules) and other such applications.
- Through this joint research, we will pursue the highest accuracy methods for evaluating cutting-edge products, thereby bolstering production and development of substrate manufacturers with advanced technologies. This will contribute to enhance their competitiveness in globally expanding electronic device markets.

Silicon nitride ceramic substrates play a pivotal role in Active Metal Brazing (AMB) substrates for power modules whose applications include inverters for electric vehicle (EV) and hybrid electric vehicle (HEV) motor control. These substrates have a function of heat dissipation during operation of power semiconductor module. Meanwhile, the thinner the substrate and higher its thermal diffusivity, the greater the operational efficiency of the power semiconductor module. Increasing adoption of EVs and HEVs is driving greater use of power semiconductor modules designed for high power, thereby culminating in rising demand for thinner substrates that feature substantial thermal dissipation performance. However, a lack of definitive methods for evaluating thermal diffusivity of substrates thinner than 0.5 millimeters has given rise to challenges with respect to ensuring consistency of measurement results. This joint research enlists AIST and its extensive knowledge of evaluation methods along with NGK and its advanced ceramic substrate technologies in efforts to collect data for quantifying the preliminary process, which affects measurement of thermal diffusivity of substrates. This will enable us to verify methods for evaluating high-performance thin substrates that are even thinner than 0.5 millimeters, such that are not yet defined under existing Japanese Industrial Standards (JIS), thereby contributing to high accuracy of measurement data and future standardization of evaluation methods.

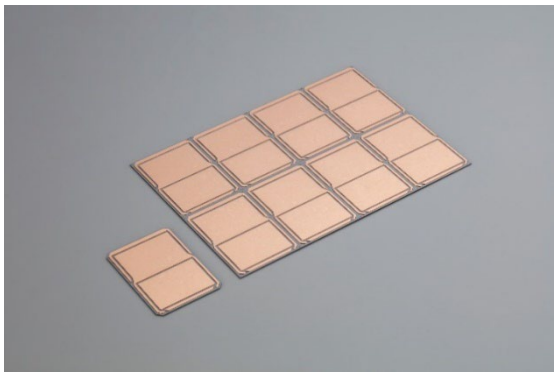
Through this joint research, AIST seeks to help bring about standardization of evaluation methods in this sector while further enhancing competitive strengths of Japanese industry by proposing solutions to industry in the form of highly precise and reproducible methods for measuring thermal diffusivity of thin substrates.

NGK will engage in this joint research with the aims of enhancing reliability of AMB substrates for power modules and helping to address societal challenges by providing its proprietary ceramics technologies and products.



Silicon nitride ceramic substrates

Silicon nitride (Si_3N_4) is widely used in bearings and structural components and materials that require heat resistance given its exceptional properties particularly in terms of its heat resistance, corrosion resistance, substantial hardness, and high thermal conductivity. Demand for silicon nitride has been mounting in recent years for use in AMB substrates for power modules in harnessing properties that include its high thermal conductivity along with its exceptional insulation performance and toughness.



AMB substrates for power modules

AMB substrates for power modules consist of a silicon nitride ceramic substrate and two copper plates. The AMB circuit substrates for power semiconductor modules of NGK have proprietary advanced bonding technology to create an extremely thin bonding layer of just a few microns or less between the ceramic substrate and copper plates. This greatly reduces thermal resistance and internal strain in the bonding layer, resulting in exceptional thermal dissipation properties.

< AIST Solutions Co.>

AIST Solutions was launched in April 2023 as an enterprise that will put a national innovation ecosystem into practice. It aspires to heighten the pace of open innovation by fully mobilizing scientific and technological expertise amassed by the National Institute of Advanced Industrial Science and Technology (AIST) and its partners with the aims of addressing societal challenges and enhancing industrial competitiveness across seven different solution domains.

<NGK INSULATORS, LTD.>

NGK is a leading company in the field of ceramics. Since its foundation in 1919, NGK has used its unique ceramic technology to provide numerous ground-breaking products that solve social issues. Today, NGK is active in more than 20 countries worldwide, with primary focus areas including mobility, energy, IoT and industry. As one of the largest manufacturers of ceramic substrates for automotive catalytic converters, NGK is actively reducing the strain on our global environment. Furthermore, NGK's products include the energy storage system "NAS" batteries, vital tools for sustainable energy infrastructure, in addition to the compact, thin, and high-energy-density lithium-ion rechargeable battery "EnerCera" series that support global IoT expansion. Through providing innovative products and services to the carbon neutral and digital society fields, NGK is committed to contributing to create new value and sustainable society.