



Joint News Release

BASF and NGK to partner on developing the next generation of sodium-sulfur batteries

- **BASF New Business and NGK INSULATORS, LTD. are expanding their existing partnership to a joint development agreement (JDA) for sodium-sulfur batteries for stationary applications**
- **The goals are to achieve an increase in power and higher number of cycles per time unit, in order to open up new market segments for NAS[®] batteries**

Nagoya, Japan, and Ludwigshafen, Germany, November 7, 2019 – BASF New Business GmbH, a wholly owned subsidiary of the German chemical company BASF, and Japanese ceramics manufacturer NGK INSULATORS, LTD. are expanding their cooperation. In addition to the sales partnership agreement for NAS[®] batteries announced in June 2019, they have now entered into a joint development agreement (JDA) to develop the next generation of sodium-sulfur batteries.

This JDA will exploit the synergy in know-how of both companies, BASF and NGK. The two companies aim to develop the next generation of sodium-sulfur batteries, making use of BASF's extensive chemistry expertise and NGK's expertise in battery design and manufacturing. The project will allow to expand the performance range of NAS batteries and thus open up new markets.

“Thanks to its unique properties, sodium-sulfur technology is ideally suited for the steadily growing market for long duration energy storage. With our envisioned technical

advancements, we want to significantly broaden the application spectrum for these batteries,” says Dr. Frank Prechtl, Director Business Build-Up E-Power-Management at BASF New Business GmbH.

“As we move towards the next generation of sodium-sulfur batteries, the interplay between the chemical processes taking place at battery cell level and the battery modules as a whole system becomes more and more crucial. BASF’s chemical expertise and our know-how in the design and production of battery modules and systems complement each other perfectly here,” adds Tatsumi Ichioka, General Manager of the NAS battery division at NGK.

NGK’s NAS battery is the world’s first commercialized megawatt-class battery which has the capacity to store large amounts of electricity for hours. The NAS battery system provides an array of superior features, including larger capacity, higher energy density and longer life compared to other battery technologies. These features are beneficial for stationary applications – in contrast to lithium-ion batteries, for example, which are suited to deliver high power over shorter periods.

The NAS battery system supports the increasing integration of fluctuating renewable energy sources, such as wind and solar, into the grid. It also enables deferral of transmission upgrade, because the electricity does not have to be transmitted immediately after being produced but can be discharged on demand. Furthermore, NAS batteries are used for the stabilization of electricity supply and emergency power supply for industrial customers and micro/off grids. Through these applications, NAS battery helps to reduce energy costs and environmental load.

About NGK

NGK is the world’s largest manufacturer of electrical insulators including 1,000-kV ultrahigh-voltage (UHV) transmission and substation insulators, and has a 100-year history. With foundations in exclusive ceramics technology, NGK contributes to environmental conservation, providing a wide range of products and technology in the “Triple E” growth fields: energy, ecology and electronics. NGK is also one of the largest

manufacturers of ceramic catalyst carriers (HONEYCERAM) and Diesel Particulate Filters (DPF) for catalytic converters for automobiles. NGK is also the world's leading manufacturer succeeding in commercialization of large capacity energy storage system (NAS battery), which has overturned the conventional wisdom "The power cannot be stored."

To learn more about NGK, visit: www.ngk-insulators.com

About NAS battery: www.ngk.co.jp/nas/

About BASF New Business

BASF New Business GmbH (BNB) searches out long-term trends and innovative topics in industry and society as well as future markets, analyzes their growth potential and checks whether potential new business areas are suitable for BASF. The activities are focused on the client sectors transportation, building and construction, consumer goods, health & nutrition, electronics, agriculture and energy & resources where new business opportunities outside of the existing businesses of BASF are identified. The most promising topics are built up as new business areas for BASF by the subsidiary. BASF New Business concentrates on new chemical-based materials, technologies and system solutions. BNB also promotes technological progress through the development of new products. To evaluate the technology and the market, BNB works closely with BASF's global research platforms and the divisions. In addition, BASF New Business cooperates with research institutes, universities, startups and industrial partners. The subsidiary BASF Venture Capital invests directly in startups that work in strategically relevant technology fields. More information at www.basf-new-business.com.

About BASF

At BASF, we create chemistry for a sustainable future. We combine economic success with environmental protection and social responsibility. The approximately 122,000 employees in the BASF Group work on contributing to the success of our customers in nearly all sectors and almost every country in the world. Our portfolio is organized into six segments: Chemicals, Materials, Industrial Solutions, Surface Technologies, Nutrition & Care and Agricultural Solutions. BASF generated sales of around €63 billion in 2018. BASF shares are traded on the stock exchange in Frankfurt (BAS) and as American Depositary Receipts (BASFY) in the U.S. Further information at www.basf.com.

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