For most people, ceramics’contributes to the images of kilns and pottery, tiles and flags, or perhaps more subtly, to our daily lives. But fewer realize that the ceramic industry keeps the modern economy ticking. For example, ceramics are the most commonly used insulators in electric systems, vital for electrical systems in vehicles. Vehicles would choke the skies with toxic gases without the ceramic substrates that power their catalytic converters. And ceramic membranes are essential for producing semiconductor, which are the building blocks of modern computing.

This abundant and versatile material, invented more than 25,000 years ago, now has another vital role to play. As the global economy commits to carbon neutrality by mid-century, it’s becoming clear that ceramics could help us decarbonize our future.

And pioneering many of these solutions for a smarter and more sustainable world is NGK Insulators, a global industrial ceramics and technology leader. “The world is currently moving towards a carbon-neutral, digital society,” says Shigeru Kobayashi, NGK’s president. “We will continue to apply our advanced technologies in responding to issues such as energy and the environment to meet the expectations of our global society.”

The road to carbon neutrality

The global transition to low-carbon energy sources is ongoing and various carbon capture, use and storage (CCUS) technologies are urgently needed to meet climate goals. The advent of CCUS means that additional solutions can separate carbon dioxide with high efficiency and distribution potential.

To address this need, NGK membranes, ceramic membranes can achieve high efficiency, are tolerant to high temperature under conditions of high temperature and pressure while being resistant to solvents and corrosion,” says Kiyoshi Bounaka, executive vice president and head of the Ceramic NV (New Value) segment overseas.

NGK had successfully developed the world’s largest ceramic CO2 separation membranes, known as a DDR-type zeolite membrane. Last year, the company took a further step towards the announcement of the successful development of a ceramic dioxide separation membrane for industrial exhaust gas.

Another vital technology needed to shift away from fossil fuels is batteries. Production of large-scale energy batteries must be stepped up to meet demand for the storage of intermittent renewable energies such as wind and solar. NGK’s advanced ceramic batteries include the grid-scale NAS battery, the world’s first zinc-ions rechargeable battery for stationary power supply, and the ultra-thin EnerCera battery, which will help companies and governments in their race to fossil-fuel-free future.

Smart ceramics from the start

In a test simulating industrial exhaust gas, the membranes achieved a CO2 absorption factor for simulated industrial exhaust gas around five times that of conventionally developed membranes. The company hopes to commercialize the technology to capture emission at factories and power plants by 2030.

Another promising option is to capture emissions already released into the air. All signs point to increasing momentum for the technology of DAC, or direct air capture of CO2, particularly in the energy sector. In 2020, governments around the world committed over $4bn to back the development and deployment of DAC tech. The first large-scale plant capable of capturing up to one million tonnes of CO2 (ARCO) per year will begin operating in the US by the mid-2020s. The International Energy Agency forecasts that DAC will need to be scaled up from the current 0.01 to 980MtCO2 by 2050.

NGK hopes to meet this challenge by developing an atmospheric CO2 adsorption module based on its HONEYCERAM technology for automotive ceramics. Bawnite was very high market potential and for such a product one demand takes off for DAC. When orders do come in, bawnites explains, NGK’s automotive ceramics factories across the globe can be rapidly reemployed to produce these products.

NGK is a key supplier of ceramic components for semiconductor manufacturing equipment, gas sensors, batteries, which are expected to be a promising option. “For these trends, NGK’s electronics and XTESemiconductor Production Equipment business has grown rapidly over the past two decades. Its digital society business, which hit record sales of ¥105bn (roughly a quarter of total sales), for the year ending in March 2022. It aims to generate some ¥300bn for 2025 by 2030 by following this road. By continuing to roll out and market unique ceramic technologies with significant impact for and for multi-cell,Logistics, automation, healthcare, and telecommunications.

“Rising is the world’s dependence on digital technology, including IoT devices. The world’s dependence on digital technology is expected to rise to 100% by 2030. In addition, NGK’s Ceramic-based NAS battery will help companies and governments in their race to fossil-fuel-free future.

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How NGK’s technology powers the carbon capture, utilisation and storage cycle (CCUS)

Currently, most wireless IoT devices are powered by single-use batteries with the hassle and cost of raw materials, or rechargeable ones with long charging times and short lifespans. Existing battery systems are not sufficiently fast enough. This prevents them from being installed through manufacturing processes using heat and limits their use in high-temperature environments.

NGK’s EnerCera battery can overcome these bottlenecks. At only 0.6mm thick and as large as a stamp, it can store high capacity and efficiency for wireless recharging technology and energy harvesting, the new

Realizing the infallible

On the face of it, an enormous intensive manufacturer which generates a substantial chunk of its sales from products to filter out exhaust from internal combustion engines would seem an unlikely champion for transitioning to a decarbonised and digitalised future. But surprisingly it’s going to start with, NGK is slashing its own emissions at a dramatic pace.

This year, the company switched over to using renewable energy in all its European factories and is aiming to make the same for all factories outside Japan by 2025. It aims to achieve carbon neutrality across all operations by 2030.

The plan is for half of all NGK’s sales by 2030—and 80% per cent by 2050—to come from products related to carbon neutrality and digital society.

To that end, the company established a new division called Corporate NV (New Value) Creation earlier this year. Some KIFSSites will be phased into IBD over the coming decade, with a mission to generate over ¥300bn in new products (which represent a fifth of current total sales) by 2031. Ceramic-based components—electrical resistance, ionic conductivity, resistance to heat and corrosion, mechanical strength—were expected to be useful in both batteries and insulators. And the ability, which NGK exults at, to manipulate its atomic-level structure and align its crystals as well as techniques for ultra-high precision-polishing and bonding means new features and applications can be unlocked.

As we race towards a smarter and more sustainable world, NGK will continue to redefine and utilize ceramic technologies to realize things which were previously considered technologically infallible.

Shigeru Kobayashi
President, NGK Insulators, Ltd.

EnerCera everywhere

Source: NGK Insulators, Ltd., registered in the U.S. and other countries.

Large-scale energy battery capacity will be vital to Sustainable grids. To counter storage energy and releasing it in times of high demand or when renewable falls, such as when the wind stops blowing or the sun stops shining. NGK’s ceramic-based NAS battery appears to be a strong candidate for such use. The battery boasts several unique features: in terms of scalability, constancy of output, lifetime of six hours or more of high electric power output, and durability. At the world’s first commercialized large-scale energy storage battery system, it is now used in about 250 locations worldwide.

Recent deployments of NAS systems include Taiwan’s Kinmen Island, German energy company, BAY’s factories worldwide, and several locations within Japan. The battery is also gaining traction as a backup power source, independent of the grid, to deal with blackouts which have increased in frequency due to natural disasters in recent years.

Images: NGK batteries effectively meet the requirements of long-term electricity storage systems for renewables.

Advertisement

A ceramics company for a smarter, carbon neutral future

We will continue to apply our advanced technologies to respond to issues such as energy and the environment to meet the expectations of our global society.

NGK Insulators, Ltd.

EnerCera battery is an ideal option to power maintenance-free IoT devices. Since its launch in 2019, NGK has conducted numerous demonstration tests for the battery’s IoT capabilities in sectors including logistics, wearables, outdoor monitoring, factory automation and smart agriculture have been developed and tested.

Along with wireless power transfer systems and logistics tracking sensors, other potential applications include renewable energy systems, wearable tech, and back-up electricity sources.

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