

# E l e c t r o n i c s

## B u s i n e s s

### Contributing to the Development of Communications Infrastructure to Bring More Comfortable Living through Functional Enhancements and Miniaturization of Products

With the rise of AI (Artificial Intelligence) and the IoT (Internet of Things), the era of exchanging enormous amounts of information at high speed is upon us. Beryllium copper products widely used in ceramic components for semiconductor manufacturing equipment and electronics components that we develop and manufacture, as well as smartphones, home appliances, automobiles, industrial equipment, etc., are closely associated with such next-generation information infrastructure.

The NGK Group provides products that meet the constantly evolving needs of society by leveraging its unique differentiation technologies for materials and manufacturing processes.

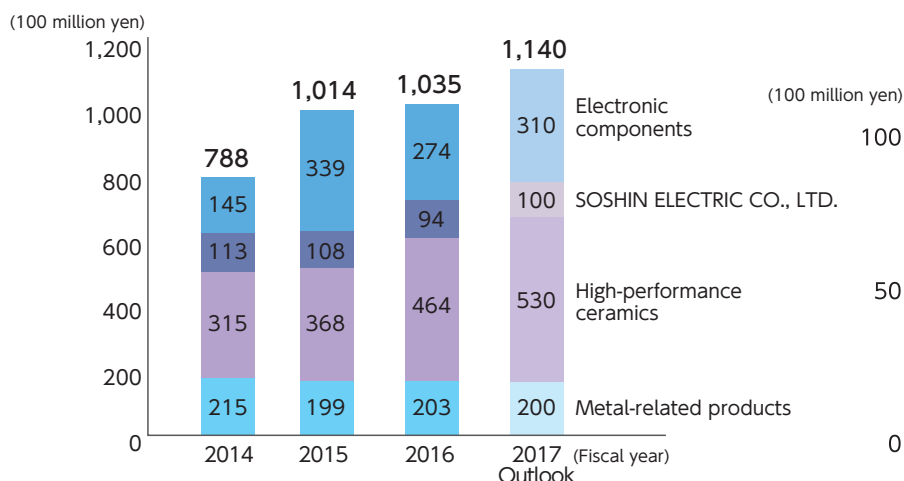


**Shuhei Ishikawa**  
 Director and Senior Vice President  
 Group Executive,  
 Electronics Business Group

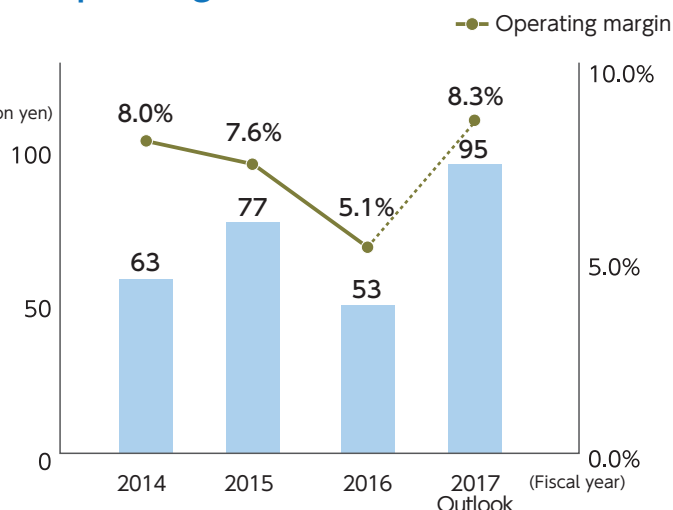
## Financial Data

### Financial results and outlook

#### Net Sales (After elimination of intersegment sales)



#### Operating Income



# Products

## Main products

### High-performance Ceramics (Ceramics for Semiconductor Manufacturing Equipment)

We provide ceramic functional components (susceptors) that support silicon wafers as a semiconductor material inside semiconductor manufacturing equipment as well as chamber components. In the face of the increasing integration of semiconductors, our products respond to increasing demand for memory and miniaturization as well as energy conservation needs for electronics components.

### Metal-related Products

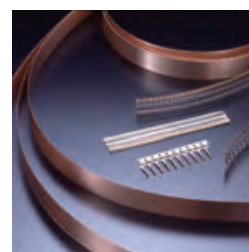
Beryllium copper, which is made by adding a small percentage of beryllium to copper, has characteristics including excellent fatigue resistance and a long service life. It is widely utilized as a material for highly reliable conductive springs and contact points. The NGK Group has also been providing nickel-tin strips since 2016.

### Electronic Components

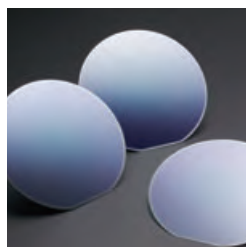
By fully exploiting our proprietary technologies cultivated over years in ceramics projects, we provide substrates for electronic devices and arc tubes for lighting purposes. In addition, electronic components for communication devices are manufactured and sold by Soshin Electric Co., Ltd. and ceramic packages by NGK Electronics Devices, Inc.



**Ceramics for semiconductor manufacturing equipment** that streamline the production process for semiconductors



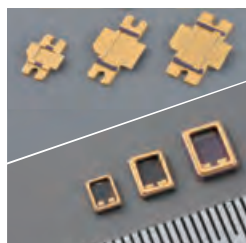
**Beryllium copper** that improves reliability of electronic devices and realizes miniaturization



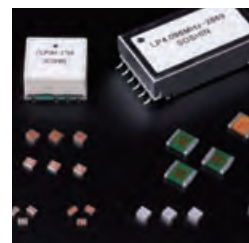
**Bonded wafers** delivering a level of performance and functionality that cannot be achieved with wafers made from a single material



Translucent **HICERAM®** alumina ceramics used as element substrates for LED devices



**Ceramic packages** for high-frequency devices that hold the world's top market share



**Electronic components for communication devices** such as multilayered dielectric filters and couplers

## Product Sites

### Manufacturing sites

High-performance Ceramics	Metal-related Products	Electronic Components
Japan	Japan	Japan
USA	USA	China
	France	Malaysia

## Results

### Business overview for fiscal 2016

### Accelerating Capital Investment in Response to Strong Demand

The Electronics Business Group on the whole posted increased sales and decreased profits compared to the previous year. This is attributable to the fact that sales remained strong backed by growth in the semiconductor market while there was a delay in recovery of demand for ceramic packages.

In the high-performance ceramics business, strong results were posted as capital investment by semiconductor manufacturers remained at a high level on the back of increasingly multilayered and miniaturized semiconductors. We also accelerated capital investments in response to strong demand.

In the metal-related products business, sales increased only slightly due to the appreciation of the yen despite an increase in shipment of beryllium copper products for industrial equipment in the Chinese market.

In the electronic components business, sales decreased as a result of the delay in investment in base stations for mobile phones in China, which negatively impacted the demand for ceramic packages.

### Summary of Fiscal 2016

**Net sales** 103.5 billion yen (2.1 billion yen increase from the previous year)

**Operating income** 5.3 billion yen (2.4 billion yen decrease from the previous year)

#### High-performance ceramics

**Net sales** 46.4 billion yen (9.6 billion yen increase from the previous year)

Sales increased from the previous year reflecting strong shipments of ceramic components for semiconductor manufacturing equipment as capital investment by semiconductor manufacturers and foundries (subcontracted semiconductor manufacturers) remained at a high level on the back of increasingly multilayered and miniaturized semiconductors.

#### Metal-related products

**Net sales** 20.3 billion yen (0.4 billion yen increase from the previous year)

Sales increased from the previous year reflecting strong shipments of beryllium copper products mainly for industrial equipment in the Chinese market.

#### Electronic components

**Net sales** 27.4 billion yen (6.5 billion yen decrease from the previous year)

Sales declined from the previous year due to sluggish demand for ceramic packages in the Chinese market despite increased volume of bonded wafers.

#### Soshin Electric Co., Ltd.

**Net sales** 9.4 billion yen (1.4 billion yen decrease from the previous year)

Sales in the fields of both industrial equipment and information communication devices remained sluggish due to a slowdown in the growth of the Chinese economy and a decline in investment in base stations

## Present Action

### Challenges and initiatives for fiscal 2017

#### Increased Sales and Profits Expected on the Back of Continued Booming of the Semiconductor Market

Increased sales and profits are expected for fiscal 2017 in the Electronics Business Group as a whole on the back of the continued booming of the semiconductor market.

In the high-performance ceramics business, capital investment by semiconductor manufacturers and foundries will remain at a high level. In order to respond to robust demand, we will expand production areas of existing plants and build new plants while focusing on the development of next-generation products in line with the increasing integration of semiconductors.

In the metal-related products business, growth has been slowing in the market for beryllium copper products and the prices of raw materials have been rising. We will redevelop our revenue structure of existing products and promote the expansion of sales of new materials and products for new applications with the aim of achieving the steady growth of profits.

In the electronic components business, we have been ramping up mass production of bonded wafers for SAW filters, looking ahead to the expansion of the high-performance filter market for mobile communication devices. As we anticipate that demand for ceramic packages will remain flat for existing products, we will accelerate the development of new products with the aim of contributing to earnings as soon as possible.

### Outlook for Fiscal 2017

**Net sales 114.0 billion yen**

(10.5 billion yen increase from the previous year)

**Operating income 9.5 billion yen**

(4.2 billion yen increase from the previous year)

#### High-performance ceramics

**Net sales 53.0 billion yen**

(6.6 billion yen increase from the previous year)

■ Sales and profits are expected to increase year-on-year as capital investment by semiconductor manufacturers and foundries is likely to continue at a high level on the back of increasing integration and segmentation of semiconductors.

#### Metal-related products

**Net sales 20.0 billion yen**

(0.3 billion yen decrease from the previous year)

■ Demand for beryllium copper products will remain flat. We will aim to expand the sales of new materials and products for new applications.

#### Electronic components

**Net sales 31.0 billion yen**

(3.6 billion yen increase from the previous year)

■ Demand for bonded wafers will increase on the back of expansion of the high-performance filter market for mobile communication devices. As we anticipate that demand for ceramic packages will remain flat for existing products, we will launch and expand the sales of new products.

#### Soshin Electric Co., Ltd.

**Net sales 10.0 billion yen**

(0.6 billion yen increase from the previous year)

■ Sales are expected to increase as a result of the expansion of sales of mainstay products in the businesses related to noise reduction, among others, by launching new products onto the market.

### Topics1

#### Boosting Production System in Response to Demand Increase

Boosting Production System in Response to Demand Increase

In the high-performance ceramics business, we have been boosting our production capacity through aggressive capital investment in light of the brisk semiconductor market. It is our aim to remain a top supplier by responding to customer demand for increased production through advanced capital investment during the phase in which makers of semiconductor manufacturing equipment are increasing production.

In Japan, we will expand production areas at our Komaki Site in order to boost production of functional components (susceptors) that support silicon wafers as a semiconductor material while establishing a new plant in Tajimi City in Gifu Prefecture. Overseas, we will open a new plant at FM Industries, Inc., our production site in the U.S., to boost production of chamber components. We will collaborate with customers in swiftly launching next-generation products onto the market, thus staying at the forefront of electronics with our advanced ceramic technologies.



Ceramics for semiconductor manufacturing equipment (susceptors)

Boosting production capacity by **25%**

#### Establishing new production site in Tajimi City, Gifu Prefecture

**Name:**

TAJIMI PLANT, NGK CERAMIC DEVICE CO. LTD. (provisional name)

**Investment amount:**

Approx. 20.0 billion yen

**Commencement of construction:**

March 2018 (scheduled)

**Commencement of production:**

April 2020 (scheduled)



New plant  
TAJIMI PLANT, NGK CERAMIC DEVICE CO. LTD. (provisional name)

● NGK's Komaki Site  
● NGK's headquarters  
● NGK's Chita Site

### Topics2

#### Intelligent Plants

At this plant for beryllium copper strips, we engage in intelligent projects for production systems by utilizing big data. By accumulating all sorts of production data in real time during the strip manufacturing process and analyzing the interactions of production criteria and quality information using big data, we can produce findings that will contribute to quality management and the forecasting of abnormalities in production lines, among other purposes. These efforts will also result in the enhancement of yield and cost reduction. We will promote similar data gathering and analysis at other plants with the aim of further expanding such efforts to electronic components plants in the future.



# Next Vision

## Future outlook and initiatives

### Achieving Mass Production of High-Function Products

With the arrival of the era of IoT and AI, a wide range of technological innovations are expected to emerge in response to the increasing volume of information and communications as well as next-generation high-speed communications. There will be opportunities for the Electronics Business Group to expand and generate new products in line with such technological innovations.

For example, future growth is expected through business expansion by launching new models of bond wafers, ceramic packages and beryllium copper strips in the areas of infrastructure development for next-generation communications and enhancement of high-speed communications and by delivering high-functional ceramic components for semiconductor manufacturing equipment in response to increased demand for semiconductor memories for data centers. On the manufacturing and development front, we have been promoting the establishment of optimal production and development systems throughout the value chain.

In the high-performance ceramics business, we respond to customer demand for increased production by developing cooperative systems (capital investment, equipment lending, guidance on manufacturing, etc.) with subcontracted processing plants. We work on the development of next-generation manufacturing equipment in close coordination with the development programs of customers.

In the metal-related products business, we promote the

integration and standardization of specifications in collaboration with material manufacturers and customers, thereby addressing the inefficiency of low-volume high-mix manufacturing.

In the electronic components business, we share key factors for quality control with material manufacturers in order to differentiate ourselves in terms of product characteristics, thus achieving mass production of high-function products. Based on material and molding technologies, we carry out a broad range of joint development projects and prototype making with companies and research institutes in various fields with the aim of developing new products.

#### Bonded Wafers for SAW Filters

That Enhance Communication Quality for Smartphones and Other Devices

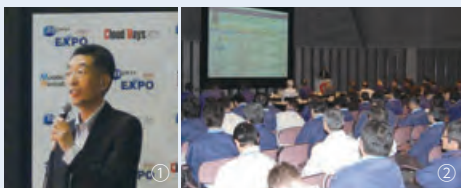


While conventional SAW (Surface Acoustic Wave) filters suffer from the disadvantage of being susceptible to a high degree of expansion and contraction based on temperature, NGK's bonded wafers realize a significant reduction in thermal expansion, thus offering solutions for next-generation LTE that require filtering functions with higher precision.

### that Utilize Big Data



The NGK Group commenced preparations for the introduction of big data analysis in 2013 and has been a leader in this field among material manufacturers.



As the NGK Group's efforts to realize cost reduction through the usage of big data received attention, Senior Vice President Ishikawa was invited to speak about the NGK Group's initiatives.

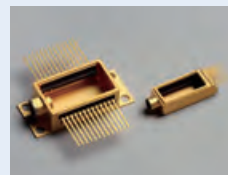
① June 2016: Special program at an IT-related exhibition  
② April 2017: Special lecture organized by a manufacturer

### Topics3

### Generating New Products Targeting New Markets and Next-Generation Products

The NGK Group has embarked on company-wide projects including the Ceramic Battery Project, which was formed last year, and the Optical component Project, which was kicked off this year (see pages 16-17). We aim to commercialize some of the products being developed in these projects within the Electronics Business Group, which will pave the way for us to enter new markets. By engaging in activities to solve problems concerning marketing, quality assurance and manufacturing from the development stage, we will strive to achieve smooth commercialization based on our business operation experience and insights.

We have been strengthening collaboration not only within NGK Insulators, Ltd. but also with Group companies. This includes our collaboration with Soshin Electric Co., Ltd. and NGK Electronics Devices, Inc. in exploring new products for the next-generation high-speed communications market. We will promote the development of new products for future growth by bringing together strengths of each company, including the material technologies of NGK Insulators, Ltd., broad network in the electronic components industry of Soshin Electric Co., Ltd., and mass production process of NGK Electronics Devices, Inc.



Optical communication packages that are used for the conversion parts of optical fiber communications. Demand is expected to increase on the back of the enhancement of high-speed communications.



Insulated circuit boards that maximize the performance of power semiconductors. Our focus has been the expansion of sales targeting the markets for industrial machinery and hybrid and electric vehicles, which offer promising growth prospects.