# TOPICS


## Radiation parts used in LED lighting at the Tokyo Skytree

N-9H® heat radiating ceramics were practically implemented for the first time in the world as LED lighting radiation parts in the Tokyo Skytree, which was completed in 2012. LEDs have low heat resistance, just like regular semiconductors, and performance degrades remarkably at temperatures at or above 100°C. LEDs used for large-sized outdoor lighting in particular have high output power and tend to store heat inside due to their design, making heat countermeasures a pressing issue. Nishimura Porcelain's ceramic heat sink—which offers heat resistance, electric insulation, and fantastic radiation characteristics—was adopted to that end. The photograph to the left is Nishimura Porcelain's product shown in *Workplace: Tokyo Skytree*, a picture book about the Tokyo Skytree (publisher: Bronze Publishing Ink; author: Noritake Suzuki).


## Exhibiting at THERMAL ENGINEERING 2015 at TECHNO-FRONTIER 2015

Nishimura Porcelain exhibited its power semiconductors and ceramic heat sink materials for electric vehicles (EV) at THERMAL ENGINEERING 2015, which was held at Makuhari Messe in May 2015. Power semiconductors reach high temperatures of 250°C or greater, so cooling methods (such as water and air cooling) and radiation parts are being explored. To that end, Nishimura Porcelain developed a heat sink material that uses radiation, leveraging the electrical insulation, heat conduction properties, and high-efficiency infrared ray radiation characteristics of ceramics at high temperatures. As EVs and other vehicles are increasingly being equipped with more electric devices, they tend to store heat inside, making heat countermeasures for devices and substrates a pressing matter. There are many cases in which cooling fans cannot be used due to space, electric power conservation, noise countermeasures, etc. Ceramic heat sinks, which are known for releasing heat via radiation, are drawing the attention of many electronic equipment and automobile manufacturers.

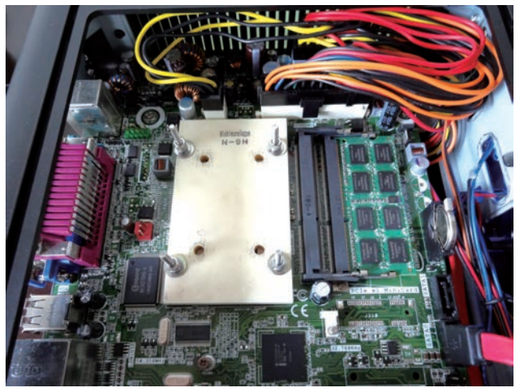
## Company history

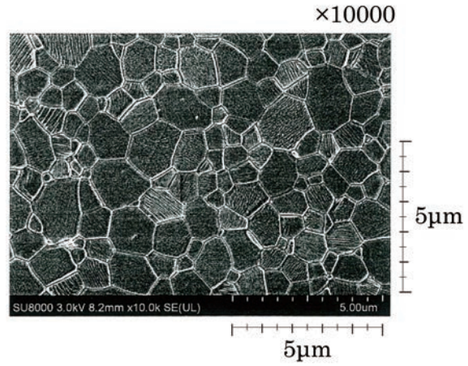
1918 Founded as the private company of the late Masajiro Nishimura in Higashiyama-ku, Kyoto-shi
1947 Nishimura Seitosho Co., Ltd. was founded in Higashiyama-ku, Kyoto-shi with capital of 198,000 yen
1948 First increase in capital to 700,000 yen. Third plant completed.
1967 Company name changed to Nishimura Porcelain Co., Ltd. Head Office building renewed. Fourth plant construction started at Yamashina-ku. Sixth increase in capital to 10 million yen.
1968 Fourth plant completed. Main plant, second plant, and third plant transferred to the new plant.
1970 Headquarters transferred to Yamashina Plant
1981 Yoshio Nishimura appointed as CEO
1994 Tenth increase in capital to 49,140,000 yen.
2008 A high-heat-radiation ceramic substrate prototype for LEDs drew much attention when exhibited at TECHNO-FRONTIER 2008 (Tokyo Big Sight).
2011 Yoshihiro Nishimura appointed as CEO
2012 Developed a high-heat-radiation ceramic substrate for LEDs (patent acquired). This product was adopted (commercialized) for lighting equipment in the Tokyo Skytree.
2013 Chosen for the FY2012 Revised Manufacturing Small to Medium Enterprise Small-Scale Business Prototype Development, Etc. Support Subsidiary Aid Project
2014 Received Oscar certification from the Advanced Science, Technology & Management Research Institute of KYOTO (ASTEM)
Chosen for the FY2013 Small to Medium Enterprise Small-Scale Business Manufacturing, Commerce, and Service Innovation Project.
Exhibited at TECHNO-FRONTIER 2014 (THERMAL ENGINEERING 2014)
2015 Chosen for the FY2014 Revised Manufacturing Small to Medium Enterprise Small-Scale Business Prototype Development, Etc. Support Subsidiary Aid Project
Exhibited at TECHNO-FRONTIER 2015 (THERMAL ENGINEERING 2015)

# FACT SHEET

## N-9H® heat radiating ceramics

### A ceramic heat sink that releases and transfers heat while insulating.






### Technology overview

This ceramic product for industrial use features excellent infrared ray radiation characteristics and has been applied in a heat sink that releases heat through radiation. Just like Kiyomizu Ware (a type of traditional industry), it has a minute, homogenous structure produced from careful craftsmanship (optimum manufacturing conditions) that are in tune with the raw materials. As electronic devices are being made progressively smaller and given greater packing density, it is increasingly important to take measures against heat for electronic parts and substrates. Meanwhile, there are more and more cases in which traditional aluminum fins and radiation fans cannot be used due to space and structural issues. By switching to the newly developed N-9H® radiation ceramics (ceramic heat sink), the user can achieve the same level of radiation. This removes the need for aluminum fins or fans, resulting in smaller sizes and energy conservation. At the same time it also removes vibration and noise, meaning that noise countermeasures are no longer needed. This product is being applied as heat sinks for CPU parts and power sources for small-size electronic equipment, laptop computers, and on-vehicle electric parts.

#### Feature 1

These alumina ceramics have a high-purity, minute, homogenous structure with uniform crystal grains. Minute pores, etc. in the grain boundary, which impair phonon conduction, have been reduced as much as possible.

#### Feature 2

- Thermal conductivity of 39W/m·k (approximately two times that of products on the market with the same purity)
- Emissivity of 0.97 (0.05 or less with aluminum, 1 with an ideal black body)
- Voltage resistance of 20kv/mm or greater

### Development background

In a heater Nishimura Porcelain developed more than 10 years ago, a quartz tube was used as a cover to prevent nichrome wires from being exposed. The quartz tube was switched to ceramics, which put out far-infrared radiation, in order to heat with infrared rays. When applying the same electric power to both, a lower temperature was measured for ceramics than the quartz tube. Therefore, Nishimura Porcelain thought ceramics could be used for cooling heating elements, including electronic parts.

### Uniqueness

This material has a crystalline particle diameter of several microns, which is extremely minute compared to general alumina. This particle diameter is also one digit smaller than general alumina. N-9H® alumina ceramics from Nishimura Porcelain were developed by utilizing the company's original manufacturing techniques. Patents have been obtained in Japan and the United States for a radiation part ceramics manufacturing method.

### The outlook for the future

There are many electronics, medical equipment, and precision equipment manufacturers in the Kansai area. Nishimura Porcelain is aiming to expand the market for the newly developed ceramic heat sink while cooperating with these corporations. It is also proactively involved in the Super Cluster Program that aims for the development and practical application of power superconductors—which is being undertaken by corporations and public experimental research institutions in the Kyoto region, centered on Kyoto University—and working to create results.

## Company Profile - Key information (as of August 2015)

Location: 3-2 Kawata Kiyomizuyaki Danchi-cho, Yamashina-ku, Kyoto-shi 607-8322
URL: http://www.nishimuratougyou.co.jp/
TEL: +81-75- 591- 1313
Fax: +81-75- 591 - 4913

Number of employees: 42
Capital: 49.14 million yen
Established: 1918
Representative: CEO Yoshihiro Nishimura

## Business areas

Manufacturing and selling industrial ceramics for electrical insulation parts, precision instrument parts, heat-resistant parts, etc.