

## **Commercialization Alliance and sheet-type development of “VSI” metamaterial heat dissipation sheet**

### **Realization of world’s first revolutionary new heat dissipation solution**



**Okitsumo Incorporated  
NICHICON CORPORATION  
KISCO Ltd.**

Okitsumo Incorporated (Okitsumo), NICHICON CORPORATION (“NICHICON”) and KISCO Ltd. (“KISCO”) have used their technological resources and formed a new operational alliance for the commercialization of “VSI\*,” an aluminum metamaterial heat dissipation sheet. Okitsumo has been working for many years on research and development of this revolutionary heat dissipation solution. VSI is rewriting the conventional wisdom on heat solutions. By selectively radiating the infrared wavelength emitted by a device’s heat source, it enables heat to pass through the device’s resin housing to be released externally. (VSI is a registered trademark of Okitsumo.)

#### **Overview and Development Background**

Combining the heat management knowledge and technology of Okitsumo (a global leader in a heat-resistant paints), the electrode foil development and production technology of NICHICON (a key global player in aluminum electrolytic capacitors), and KISCO’s wide ranging experience in handling heat-dissipating materials in the electronics market, the three companies will provide effective solutions for thermal management issues. Thermal management is a common challenge faced in a number of fields such as 5G smartphones, various electronic devices, in-vehicle electronics, and LED lighting, and other devices using sealed resin housings. The three companies have completed development of sheet type VSI (15 square cm), and are ready for sampling.

VSI will be displayed at NICHICON’s booth at TECHNO-FRONTIER 2021’s 36th Power System Japan Expo.

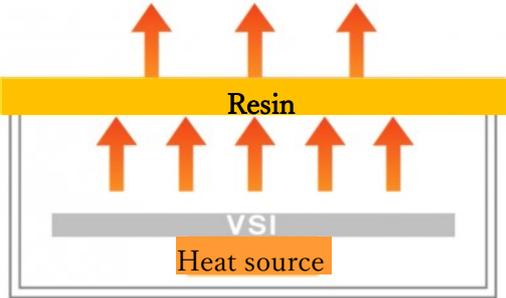
#### **About VSI metamaterial heat dissipation sheet**

VSI is a heat dissipation sheet developed by Okitsumo. Microcavities on the surface of the sheet selectively radiates out heat in the infrared wavelength range. This enables heat sealed into a cramped space by resins to escape in the form of infrared rays.

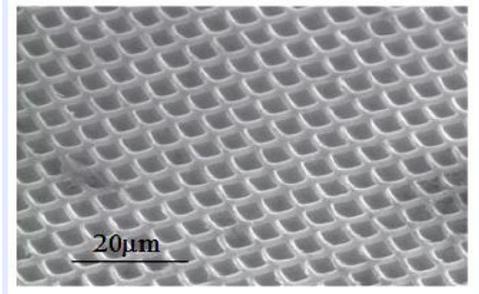
Unique feature 1: New heat dissipation method that selectively emits infrared wavelengths  
(practical application of metamaterial technology)

Unique feature 2: Adept at dissipating heat in confined resin spaces. Compared to thermal conductance, it suppresses heat source temperatures as well as solves the problem of heat spots that occur in resin casings.

**The principle and structure of the VSI metamaterial heat dissipation sheet**



Transfer of heat outside the resin casing via selective infrared radiation



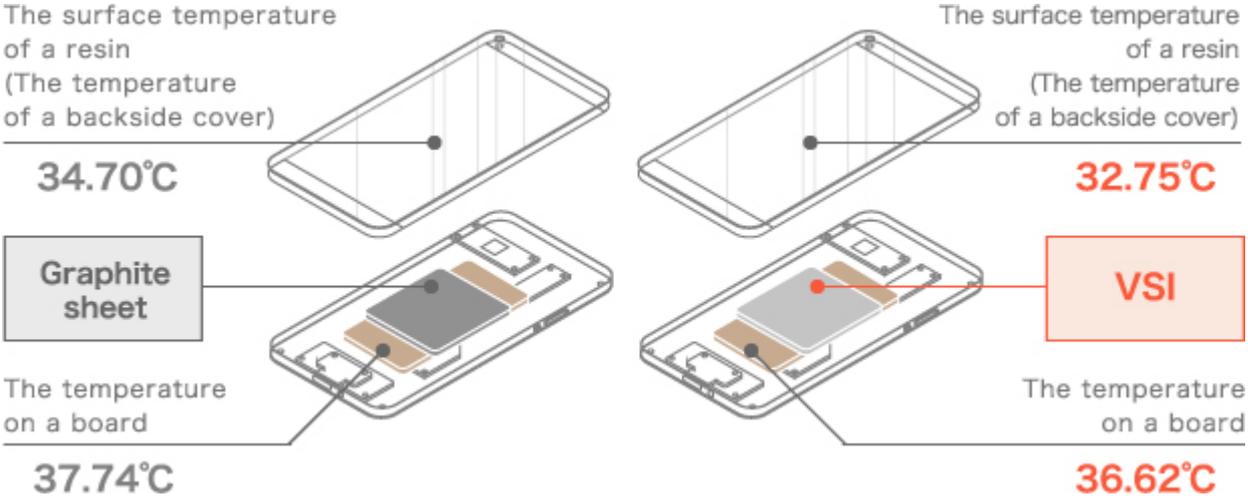
Microcavity construction

\* A video demonstration of VSI metamaterial heat dissipation sheet is available here: <https://www.youtube.com/watch?v=iYI4iKtGdrw>

**Heat releasing effectiveness of the VSI metamaterial heat dissipation sheet**

We tested heat dissipation effectiveness by disassembling retail smartphones and replacing their graphite heat dissipation sheets with VSI, both of which are 30 square mm in size.

Test results indicate that switching to VSI reduced CPU temperatures by 1.12°C and surface temperature of the resin back cover by 1.95°C, thus confirming superior heat dissipation properties compared to graphite.



## **Purpose of the alliance**

The three companies will make maximum use of their technological abilities and collaborate on development and production in order to fast-track the commercialization of VSI heat dissipation material.

### 《Each company's role》

#### ■Okitsumo

Okitsumo holds a basic patent on the technology for releasing heat to the outside of a resin casing via selective infrared wavelength radiation\*. It will also utilize its knowledge of periodic microstructure processing technology and thermal control, which are indispensable for the production of metamaterial heat dissipation sheets.

\*The basic patent is jointly held by Okitsumo and Tohoku University

#### ■NICHICON

NICHICON will utilize its ultra-fine surface processing technology (at the several microns level) that it has cultivated in the development and production of electrode foil, which is a crucial material for aluminum electrolytic capacitors.

#### ■KISCO

In order to deliver optimum heat dissipating effectiveness, KISCO will utilize its techniques for fabricating heat dissipation sheets customized to customer specifications, and its knowledge regarding the combination of adhesive and film materials.

## **About metamaterial**

A metamaterial is a substance that is artificially created with a structure that cannot be obtained with substances naturally ("metamaterial" means a "material beyond material" that has a calculated shape).

## **【For media inquiries regarding this press release】**

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