

**DOWA achieves commercialization of copper-graphite composite base plate,
a heat-releasing material for semiconductor modules**

DOWA METALTECH CO., LTD. (Headquarters: 14-1 Sotokanda 4-chome, Chiyoda-ku, Tokyo; Capital: 1 billion yen; President: Akira Sugawara; hereinafter "DOWA METALTECH"), a subsidiary of DOWA HOLDINGS CO., LTD. (Headquarters: same as above; Capital: 36.4 billion yen; President: Masao Yamada), industrialized a copper-graphite composite base plate for high-power semiconductor modules through joint development with The Goodsystem Corporation (Headquarters: 125, Mongnae-ro Danwon-gu, Ansan-si, Gyeonggi-do, Korea; CEO: Meoungwhan Cho) in South Korea. DOWA METALTECH has begun to supply samples of the base plate as "CNG40V1."

High-power semiconductor modules are used mainly in information and telecommunications field, which has recently experienced a trend toward higher speed and increased capacity. Reflecting the increased power output and number of chips per package area, the amount of heat generated from those semiconductor modules has also increased. Accordingly, high-power semiconductor modules require the use of base plates with higher thermal conductivity and lower thermal expandability than conventional ones.

Generally, conventional base plates have a laminated structure of pure copper and copper-molybdenum alloy. To improve the thermal conductivity in the thickness direction of these base plates, the ratio of the pure copper layer needs to be increased. However, because pure copper has high thermal expandability, the differential thermal expansion with other materials causes the base plate to be warped when it is mounted.

As a result of the joint development, DOWA METALTECH has established an industrial method that enables a large quantity of two materials to be evenly blended by applying its unique manufacturing process, in which graphite powder is coated with copper and sintered. This process makes it possible to orient scale-like graphite as intended. The copper-graphite composite base plate has a structure in which the copper-molybdenum alloy cells are filled with copper-graphite powder. This structure has enabled a reduction in thermal expansion. In addition, it has enabled an improvement in thermal conductivity in the thickness direction of the base plate while maintaining thermal conductivity on the surface, efficiently cooling the semiconductors.

This feature of the copper-graphite composite base plate allows for a smaller size and lighter weight than conventional base plates. This copper-graphite composite base plate is expected to be used for mobile phone base stations and peripheral communication equipment by being mounted on RF

modules^{*1} for 5G wireless communications, the next-generation mobile communication system that is expected to grow in the future. Its application for equipment including IGBT modules^{*2}, which are mounted on electric vehicles and hybrid vehicles, is also being studied. DOWA METALTECH has already begun to take initiatives, including the shipment of samples and provision of technology information to some customers.

This copper-graphite composite base plate will be marketed in Japan by Hoei Shoji Co., Ltd. (Headquarters: 1598-1, Kotehashi-cho, Hanamigawa-ku, Chiba-shi, Chiba; Capital: 110 million yen; President: Takashi Itoh), a subsidiary of DOWA METALTECH.

DOWA METALTECH will continue to make full use of cutting-edge technologies to provide materials for automobiles and consumer equipment to customers all over the world.

*1: RF (Radio Frequency) module: A semiconductor module used for sending and receiving radio frequencies

*2: IGBT (Insulated Gate Bipolar Transistor) module: A semiconductor module for quickly controlling current, voltage, frequency, and other elements in a relatively large power domain

<Features of CNG40V1, a copper-graphite composite base plate>

*Figures in [] indicate a comparison with 40Cu-60Mo alloy, unless otherwise mentioned.

- Thermal conductivity: 375 W/(m·K) [69% improvement]
- Thermal expansion coefficient: 7.7 ppm/K [Difference from thermal expansion coefficient of alumina: 41% decrease]
- Density: 6.0 g/cm³ [37% decrease]



Figure 1. Copper-graphite powder

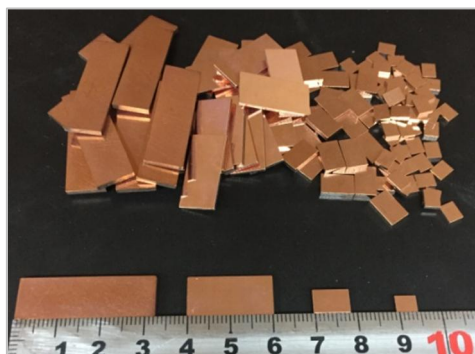


Figure 2. CNG40V1, the newly developed copper-graphite composite base plate

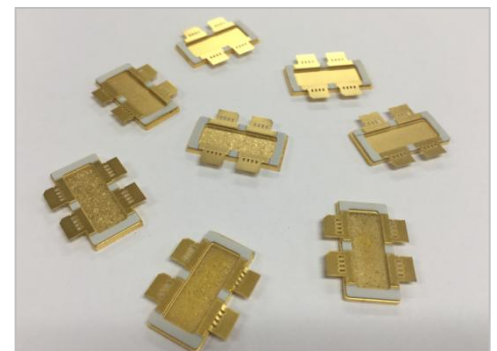


Figure 3. Example of application: Case for wireless communications

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