

April 12, 2012

Tanaka Precious Metals
Tanaka Holdings Co., Ltd.

Tanaka Kikinzoku Kogyo Starts Providing Active Brazing Filler Metal Able to Directly Bond to Ceramics at Half the Conventional Cost

Optimal for joining of heat sinks for power semiconductors used in hybrid vehicles and inverters

Tanaka Holdings Co., Ltd. (a company of Tanaka Precious Metals, Head office: Chiyoda-ku, Tokyo; President & CEO: Hideya Okamoto) today announced that Tanaka Kikinzoku Kogyo K.K. (Head office: Chiyoda-ku, Tokyo; President & CEO: Hideya Okamoto), which operates the Tanaka Precious Metals' manufacturing business, will start providing TKC-651 active brazing filler metal able to directly bond to ceramics at half the material cost of conventional active brazing filler metals.

TKC-651 is an active brazing filler metal comprising an alloy of silver (Ag), copper (Cu) and titanium (Ti) that can be used for brazing^(*) to ceramics with a single application of heat. The conventional active brazing filler metal had difficulty in supply in sheet thicknesses of 100 micrometers or less, but TKC-651 can be supplied with a sheet thickness of as thin as 50 micrometers, and because Ag content has been controlled to around 6%, the material cost can be reduced to half the conventional level, making it an unprecedented active brazing filler metal.

A brazing method called metallization that controls material costs has been used in products requiring joining to ceramics, such as electronics including heat sinks for power semiconductors used in hybrid vehicles and inverters, decorative items and dental materials. As TKC-651 is able to reduce material costs to half those of conventional active brazing filler metals, it is possible to significantly improve production speed, which was a shortcoming of metallization, without increasing running costs even if an alternative technique is used in place of metallization.

■ Obstacles to the Spread of Active Brazing

There are two methods used for joining ceramics to each other and ceramics to metals – metallization forming a thin layer with good wettability to the ceramic surface, and active brazing where metal to activate wettability is added to the brazing filler metal. Metallization is a method in which a layer of molybdenum (Mo), Manganese (Mn), etc. is metalized on a ceramic surface, and nickel (Ni) plating is applied, then brazing alloy (BAg-8) is used for joining. Many users have been using metallization due to advantages such as excellent bonding strength and economy, but because of its shortcoming of requiring a complex process, there has been a longstanding demand to simplify the process.

Meanwhile, active brazing does not require a metalized layer because it is a method that enables direct joining to ceramics with a single application of heat by improving the wettability (ease of application) to ceramics by adding active metal such as Ti, zirconium (Zr), hafnium (Hf), etc. to the brazing filler metal. The active brazing filler metals with the best joining properties are Ag-Cu-Ti alloys, and Tanaka Kikinzoku Kogyo has been providing TKC-711, which is the predecessor of TKC-651.

However, if the additive rate of Ti exceeds 1.5% in conventional active brazing filler metal, CuTi compounds with a diameter of 100 micrometers are deposited in the material. Because the deposited CuTi compound is extremely hard and cannot be molded in plastic forming, and only AgCu undergoes plastic forming, the CuTi compound falls out when finely processed, and this can cause breaks if processed in thin wires. Because of this, sheet thickness needed to be at least 100 micrometers to ensure sufficient wettability while keeping the Ti additive rate below 1.5%. Furthermore, because of the difficulty in manufacturing wires, high material costs and poor workability were obstacles to the spread of active brazing.

■ Successful Development of Active Brazing Filler Metal with Excellent Economic Efficiency and Joining Speed - Enabling Full-scale Replacement of Metallization Method-

The TKC-651 successfully developed by Tanaka Kikinzoku Kogyo adds an appropriate amount of tin (Sn) to Ag-Cu-Ti alloy active brazing filler metal to provide the conditions for the formation of CuTi compound being finely deposited as SnTi compound, enabling provision as leaf with a sheet thickness of 50 micrometers and wire with a diameter of 200 micrometers. Direct bonding with ceramic is possible in 1 to 5 minutes by heating TKC-651 to 790-850°C in a vacuum of 0.02 pascals (2×10^{-2} Pa) or less, or in an inert atmosphere of argon (Ar), etc. with a dew point of -55°C or less. This is perfect for an alternative technique to metallization because material costs can be reduced to half compared to conventional active brazing filler metal.

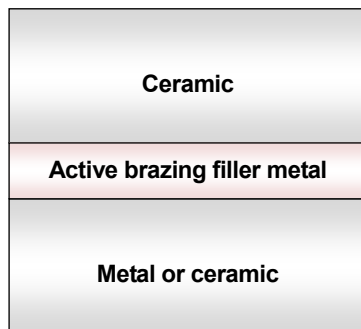
Tanaka Kikinzoku Kogyo is aiming for monthly sales of 5 million yen by selling TKC-651 to users in a wide range of fields such as heat sink makers and manufacturers of decorative items and ceramic dental materials. We will continue to develop technologies with an eye to expand our lineup of active brazing filler metals to respond to customers' needs in the future.



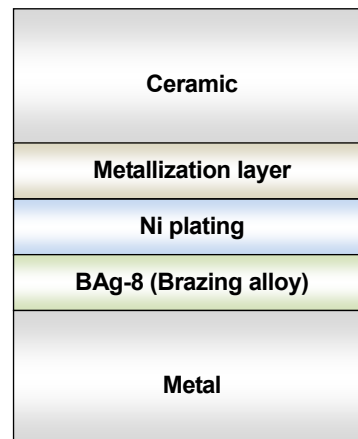
TBC-651 active brazing filler metal

[Reference] Comparison of bonding mechanisms

Active Brazing Method



Metallization Method



(*1) Brazing

A method of joining metals, etc., in which an alloy (brazing filler metal) with a lower melting point than the base materials being bonded is melted to ensure that the base materials are melted as little as possible.

■**Tanaka Holdings Co., Ltd. (Holding company of Tanaka Precious Metals)**

Headquarters: 22F, Tokyo Building, 2-7-3 Marunouchi, Chiyoda-ku, Tokyo

Representative: Hideya Okamoto, President & CEO

Founded: 1885

Incorporated: 1918

Capital: 500 million yen

Employees in consolidated group: 3,456 (FY2010)

Net sales of consolidated group: 891.0 billion yen (FY2010)

Main businesses of the group:

Manufacture, sales, import and export of precious metals (platinum, gold, silver, and others) and various types of industrial precious metals products. Recycling and refining of precious metals.

Website: <http://www.tanaka.co.jp/english>

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Headquarters: 22F, Tokyo Building, 2-7-3 Marunouchi, Chiyoda-ku, Tokyo

Representative: Hideya Okamoto, President & CEO

Founded: 1885

Incorporated: 1918

Capital: 500 million yen

Employees: 1,532 (FY2010)

Sales: 865.4 billion yen (FY2010)

Businesses:

Manufacture, sales, import and export of precious metals (platinum, gold, silver, and others) and various types of industrial precious metals products. Recycling and refining of precious metals.

Website: <http://pro.tanaka.co.jp/en>

<About the Tanaka Precious Metals>

Established in 1885, the Tanaka Precious Metals has built a diversified range of business activities focused on the use of precious metals. On April 1, 2010, the group was reorganized with Tanaka Holdings Co., Ltd. as the holding company (parent company) of the Tanaka Precious Metals. In addition to strengthening corporate governance, the company aims to improve overall service to customers by ensuring efficient management and dynamic execution of operations. Tanaka Precious Metals is committed, as a specialist corporate entity, to providing a diverse range of products through cooperation among group companies.

Tanaka Precious Metals is in the top class in Japan in terms of the volume of precious metal handled, and for many years the group has developed and stably supplied industrial precious metals, in addition to providing accessories and savings commodities utilizing precious metals. As precious metal professionals, the Group will continue to contribute to enriching people's lives in the future.

The eight core companies in the Tanaka Precious Metals are as follows.

- Tanaka Holdings Co., Ltd. (pure holding company)
- Tanaka Kikinzoku Hanbai K.K.
- Tanaka Denshi Kogyo K.K.
- Tanaka Kikinzoku Jewelry K.K.
- Tanaka Kikinzoku Kogyo K.K.
- Tanaka Kikinzoku International K.K.
- Electroplating Engineers of Japan, Limited
- Tanaka Kikinzoku Business Service K.K.