Product Report

Product Introduction

Conductive Adhesive [TCB Series]

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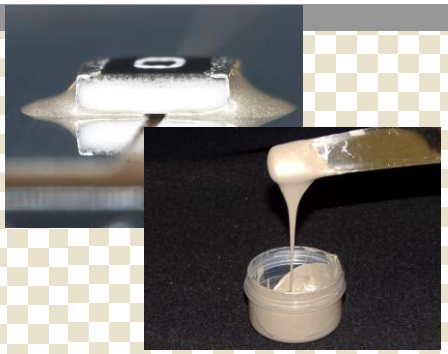

TCB series appearance (front), chip mounting image (rear)

[1. Introduction]

In general, solder bonding is used when bonding the electronic components used in electronic devices such as personal computers and mobile phones. However, although solder can be used for bonding to a substrate that has high heat resistance, such as a metal or ceramic substrate, it is difficult to use it for bonding to a substrate that has medium or low temperature heat resistance, such as a resin film or paper. On the other hand, another method for bonding electronic components is to use a conductive adhesive. This is an adhesive obtained by dispersing silver in a binder component that is mainly composed of organic matter. The adhesion mechanism and conductive mechanism are that the curing of the organic matter maintains the bonding force with the object bonded to, and the metal particles contained ensure electrical conductivity. The curing temperature is different from that of solder, and curing can be carried out at a relatively low temperature, so this makes it possible to conduct bonding on the substrates with medium or low temperature heat resistance mentioned above. However, the silver used in the conductive adhesive is a very expensive metal and also has the disadvantage of poor migration resistance, so the proposal of an alternative material is desired.

On the other side, the material used on the side to be bonded to is something like a copper substrate, a copper substrate coated with a gold flash plating, or a film formed by printing a silver paste or the like. The use of these metals also leads to higher costs for the final product.

This report contains the results of an evaluation of an adhesive [TCB Series] using silver-coated silica powder [TFM-S02P] as a method to reduce the cost of conductive adhesive. First is a report of the electrical characteristics evaluated on the adhesive alone. This report also contains the results of evaluations of the electrical and mechanical properties when aluminum is used on the side to be bonded to.

[2. Conductive Adhesive TCB Series]

Figure 1 shows the 2 μm silver-coated silica powder made by Toyo Aluminium K.K. (Product name: TFM-S02P) that was the conductive powder used in the preparation of the conductive adhesive [TCB Series]. By using the ceramic powder, the amount of silver is smaller and the specific gravity becomes about 1/3 that when using the silver powder, so a drastic cost reduction is expected. The conductive adhesive was obtained by mixing and dispersing this powder in a predetermined amount of epoxy resin and adding a curing agent. The curing conditions are 150°C/30 minutes.

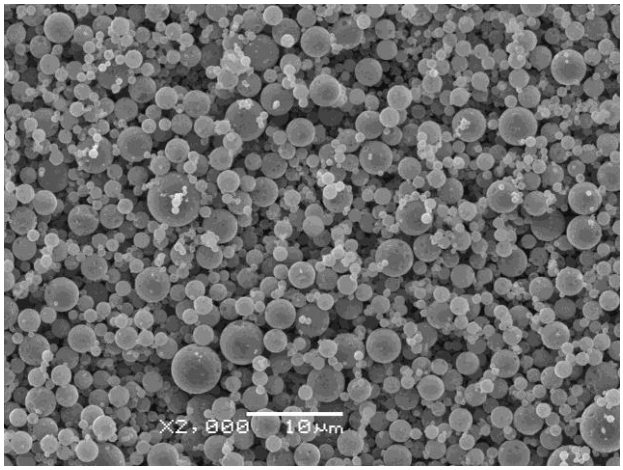

Figure 1. Surface Profile of TFM-S02P

[3. Specific Resistance Measurement Results]

Figure 2 shows the results of the specific resistance measurements on the conductive adhesive produced. For comparison, the results from conductive adhesives made by other companies using silver powder are shown. The specific resistance value of the [TCB Series] was comparable to that of the commercially available conductive adhesives using silver powder. This suggests that sufficient conductivity can be obtained by using the [TCB Series] using silver-coated

silica powder [TFM-S02P], and that it may be used as an alternative to conductive adhesive using expensive silver powder.

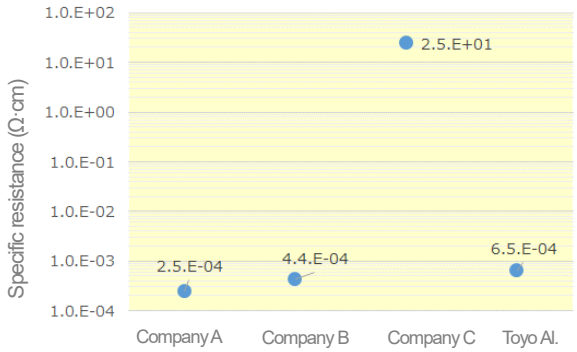

Figure 2. Specific Resistance Measurement Results

[4. Tensile Strength Measurement Results]

In order to measure the tensile strength with aluminum, which is the side to be bonded to, the JIS K 6850 test method was followed and evaluations were conducted on a sample obtained by using the conductive adhesive to superimpose aluminum plates. Figure 3 shows the evaluation results. From the results in Figure 3, the tensile strength of the [TCB Series] was found in the results to be almost equal to the tensile strengths of the commercial conductive adhesives using silver powder.

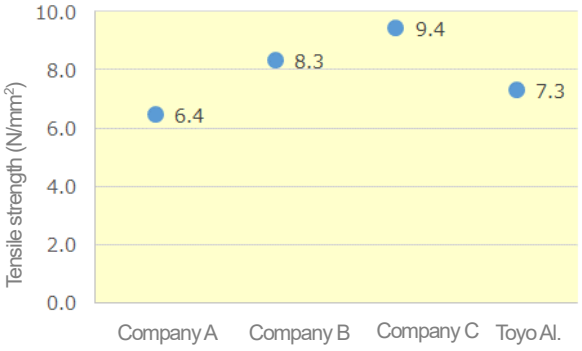

Figure 3. Results of Tensile Strength Test

[5. Interface Resistance with Aluminum Foil]

For the evaluation of the interface resistance between the conductive adhesive and aluminum, the standard evaluation method considered by the NEDO (New Energy and Industrial Technology Development Organization) project for conductive adhesives (ISO 16525-2) was used as a reference. As shown in Figure 4, a substrate was produced by etching an aluminum foil width of 5 mm at an interval of 1 cm. A screen printing machine was then used to print the conductive adhesive on the aluminum with a line width of 2.5 mm. The resistance values were then measured between the aluminum foils to evaluate the sample. Figure 5 shows the evaluation results.

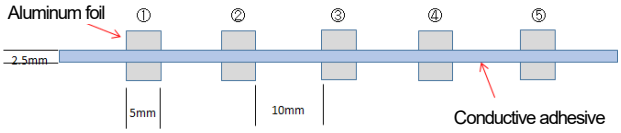

Figure 4. Sample for Interface Resistance Measurement

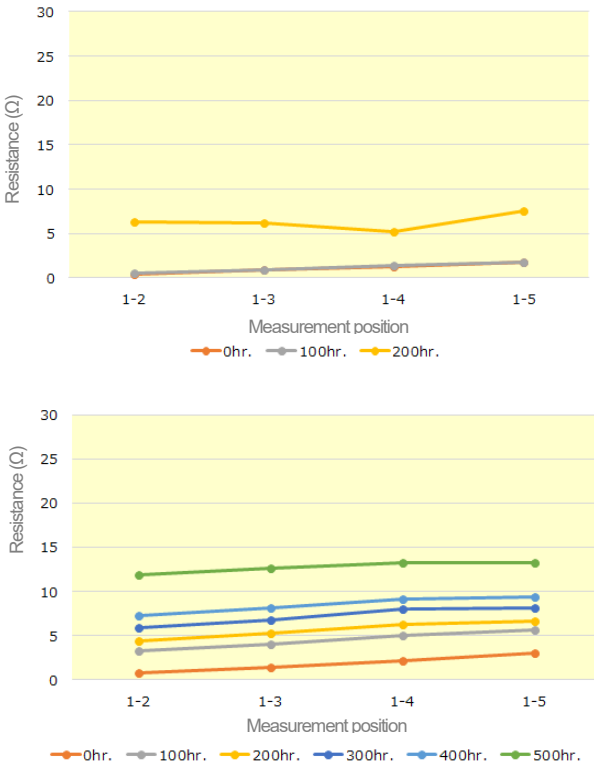

Figure 5. Resistance Evaluation Results for Conductive Adhesive/Al Foil Interface (Top: Manufactured by Company A, Bottom: Manufactured by Toyo Aluminum)

The resistance value of the prepared samples was evaluated in an 85°C/85% constant temperature and humidity environment. In the results, while the resistance value of the commercial conductive adhesive using silver powder fell outside of the measuring range after 300 hours or more, the linearity of the [TCB Series] was maintained after 500 hours. It is assumed that the difference from the commercial product was caused by the occurrence of corrosion due to the potential difference between silver and aluminum under the constant temperature and humidity environment, which is assumed to have resulted in a deterioration of the resistance value.

[6. Future Prospects]

In comparison with general silver powder conductive adhesives, the product developed had almost equivalent performance, such as mechanical performance and electrical resistance, and also can be expected to achieve a drastic reduction of costs. It can be expected that the product will be applied to a variety of base substrates where the use of solder in the high temperature region has been difficult, such as in bonding to organic film and paper and other substrates with medium to low temperature heat resistance, and in chip mounting on aluminum materials.