

Study on Conductivity and Mechanical Properties of New Graphene/Copper Composites Bonding Wire

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Abstract

Insulated gate bipolar transistors (IGBTs) are widely used in many industries such as for energy purposes, solar inverters, UPS, aviation and electric vehicles. Wire bonding is still the most popular chip interconnect technology in IGBT high power module packaging. Cu bonding wire is the most common used material with low-cost, higher electrical and thermal conductivity. As the power density of IGBTs continues to increase, the Cu-bonding for IGBT packages are becoming higher and higher. Graphene is a 2D nanomaterial with superior electronic, thermal, optical and mechanical properties. Thus, Gr can the enabled progress in the development of the Gr/Cu composite bonding material.

This investigated the conductivity, mechanical properties of both Cu and Gr/Cu composite bonding wires. Another, the simulation environment for heat treatment was carried out in air at 300°C for 3 mins. The results show that the electrical conductivity of the Cu and Gr/Cu composites bonding wire are 8.19×10^7 S/m and 8.81×10^7 S/m, respectively. The mechanical Tensile properties of Gr/Cu composite bonding wire exhibited a better of the 0.2% proof stress (0.2YS) and ultimate tensile strength (UTS) than pure Cu, respectively. However, the elongation (EL) of Gr/Cu was also slightly poor than that of pure Cu. It is worth noting that the graphene/Cu composite wire exhibits a 0.2YS of 372.4 MPa after annealing at 300°C for 3 min, which is improvement in 0.2YS compared to that of Cu wire (296.9 MPa). This indicates that this Gr/Cu composite bonding wire potentially could be used for bonding in IGBTs.

References

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Figures

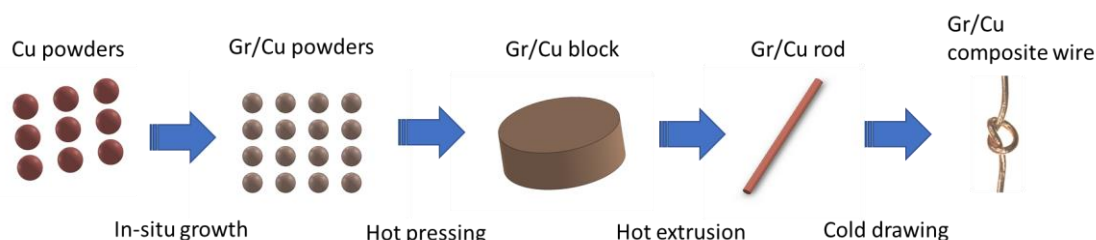


Figure 1: The schematic diagram of the preparation process of the Gr/Cu composite bonding wire.

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