

Joining ceramics to metals by a newly designed Cu-base active filler alloy

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Abstract

A new active filler alloy was developed to join the ceramics to metals by a single-stage route. Metallization is rarely used nowadays due to containing many stages and high costs. Brazing is the most used method to join such a connection. Most researchers have used Ag-Cu-Ti filler alloys to join ceramic materials to ceramics or metals. These silver-based alloys have high costs due to the presence of Ag element. Therefore, a Cu-base active filler alloy with a chemical composition of Cu-20.5% Sn- 20% Ag- 3.5% Ti was developed using the phase diagrams and thermodynamic rules. XRD, EDS, SEM and DSC analyses were performed to evaluate the developed filler alloy. It was concluded that the Cu₄₁Sn₁₁ intermetallic was the most destructive phase in the alloy. An MMC composite was joined to the copper to study the mechanical properties of the resultant joint. The highest tensile strength obtained 140 MPa for Cu-1.1% Al₂O₃ – Cu joint. Also, the wetting angles of the filler alloy on the composite were measured by the drop test where the lowest wetting angle obtained as 10°.

Keywords: ceramic to metal, metal matrix composite, active filler alloy, active brazing, wetting

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