A6061 Vacuum Brazing

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ABSTRACT

Heat dissipation requirement in aerospace and electronic industries is very important because of high-temperature environment, so the assembly process of heat dissipation components is complex and requires high precision and a watertight feature. Aluminum alloys would have defects inside weld beads of Vacuum Brazing (VB), so far there is still no better solution for this problem, and these defects are often the main cause resulting in that airtight requirement can not be achieved by heat dissipation components. Therefore, in addition to confirming optimal bonding parameters, this study also explored the causes leading to defects of A6061 VB and conducted process improvement. Furthermore, since both aluminum and copper have both good thermal conductivity and electrical conductivity properties, they are often used to manufacture related components in photoelectric and semiconductor devices; however, if they are to be bonded, it is easy to generate an oxide layer resulting in poor welding quality on both of them because their melting point difference is too large. Nevertheless, this can be overcome through VB technique. The results of this study revealed, the optimal parameters of A6061-A6061 VB are: Al-Si filler-607oC/ holding temperature for 60 minutes, and exerted with a pressure of 75MPa; Al-Si-Cu filler -607oC/ holding temperature for 60 minutes, and exerted with a pressure of 75MPa. However, the shear strength of using Al-Si-Cu as filler is lower than that of using Al-Si as filler. But when adopted Diffusion Bonding (DB) without using filler to weld A6061-C10100, the maximum tensile strength 38.32MPa occurred at 545oC/ holding temperature for 15 minutes; while using Al-Si-Cu as filler, have a maximum tensile strength 30.07MPa also at 545oC/ holding temperature for 15 minutes; and when using Al-Si as filler, a maximum tensile strength 34.52 MPa occurred at 555oC/ holding temperature for 15 minutes. The consolidated result revealed, although DB can achieve the greatest shear strength, but the process parameters must be controlled within a relatively narrow scope; while more generous process parameters can be used when using Al-Si as filler. From the observation of microstructure it is shown that, a dense layer of Al-Cu intermetallic compound will be produced on copper side regardless of adopted DB or VB with filler, and the hardness of this intermetallic compound is much higher than those of base materials and weld beads.

Keywords : A6061、C10100、vacuum brazing、diffusion bonding、defect、intermetallic compound

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