J Biot Phyt 2017

Glow discharge plasma brazing of Ti-45Al-2Nb-2Mn-1B titanium aluminide with Ti-Ni-Cu alloys

Ahmad Reza Rastkar
Shahid Beheshti University, Iran

TiAl intermetallics are considered as promising materials for high-temperature application especially in advanced automobile and aero engine components because of their low density and high melting temperature and high-temperature strength. Practical application of γ-TiAl alloys depends on the proper joining of these alloys as a key factor in aircraft and automobile technology. It has been reported that sound joints could be achieved by solid-state diffusion bonding and reaction-assisted diffusion bonding. A pulsed DC plasma in the highest amperage range of glow discharge was employed to join the parts of Ti-45Al-2Nb-2Mn-1B titanium aluminide at 900° C for 15 min at 10 mbar pressure with Ti-Ni-Cu (wt.%) alloys. The glow discharge surrounded the whole volume of the joint assembly and the brazing was performed like conventional furnace heating. The cross-section of the joints was analyzed by using optical and SEM microscopy, EDX and XRD spectroscopy and microhardness and shear fracture tests. Microscopy of the joints showed a different irregular type of particles in the interfacial regions with a chemical composition of Ti2AlNi, TiAlNi and NiAl3 enriched with Cu and Mn in matrices composed of TiAl, Ti3Al, and TiAl3. The microhardness of the interfacial regions was approximately slightly harder than the base metal and a good matching was observed between the joint and the base metals. Cracking was not observed in the joints. The maximum shear strength of the joints was approximately 400 MPa for the specimen brazed with Ti-30% Ni filler metal in comparison with the base metal with the strength of 500 MPa.

a-rastkar@sbu.ac.ir