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Abstract
Both 2000 and 7000 series are high strength, heat treatment aluminum alloys with high specific strength and excellent corrosion resistance. Although it’s used widely in aerospace industry, it’s still difficult to get the excellent quality from traditional fusion welding. Electron beam welding (EBW) is the nontraditional, high energy density welding process. Because the welding process in vacuum to lead to a few porosity defects for the aluminum alloys welding. So it’s also suitable for aluminum alloys welding. Friction stir welding (FSW) is a solid-state joining process. Because it doesn’t reach the melting point of the alloys during the welding process, there is no porosity problem caused by the metal without melting evaporation, especially suitable for aluminum alloys. In this study used of EBW and FSW which aim at AA2024-T3 and AA7075-T6 in 5 mm to the same and dissimilar butt welding, to discuss the variation of the micro-structure, precipitates, and micro hardness of weld. Experimental result shows, that fine grain can be got in the EBW weld due to high cooling rate. However, the weld structure of FSW can produce the fine equiaxed grain structure through the dynamic recrystallization. Both sizes of the grain are much smaller than the parent metal. No matter same or dissimilar sizes of butt welding in AA2024-T3 and AA7075-T6 are smaller than EBW. In TEM analysis, Because EBW is a high cooling rate fusion welding process, there is no precipitation in the weld. So that the hardness of weld of FSW is larger than EBW. Nevertheless, the size and number of precipitation will be affected by the temperature variation during the process of FSW. In the AA2024-T3 butt welding of FSW, Ω-phase becomes coarsened accordingly as the increasing temperature in the zone from BM、HAZ、 TMAZ to STZ. In addition, SU+B4(S)-phase also becomes coarsened and increased accordingly as the quantity and size of HAZ to TMAZ. In the AA7075-T6 butt weld specimen of FSW, from BM、HAZ、TMAZ to STZ, the precipitation inter the grain (ηU+B4-phase、like Mg32(Al,Zn)49) and in the grain boundary (η-phase) becomes grown caused by temperature increasing ; moreover, the grain boundary precipitation in HAZ and TMAZ is not distributed continuously, but in BM and STZ, it’s distributed continuously.
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