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Friction stir brazing of 6061 aluminum alloy and H62 brass: Evaluation of microstructure, mechanical and fracture behavior

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Abstract

In this study, friction stir brazing (FSB) was applied to join 6061 aluminum to H62 brass with the aid of zinc foil. The thermal history of interface was measured by thermocouple. The interfacial microstructure variations under different welding speeds were analyzed via scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). Additionally, an overlap shearing test was conducted to evaluate the influences of welding speeds on the failure loads of corresponding FSBed joints. Furthermore, typical sound joint was evaluated by peel test to investigate the effect of zinc foil on the fracture behavior and the diffusion reaction products on both aluminum and brass side. The results reveal that the change of traveling speed has significant effect on the thickness of interlayer as well as the cooling rate, but little on the peak temperature. Besides, the maximum failure load can be achieved as high as 7.62KN at rotational speed of 1800 rpm and the traveling speed of 60 mm/min, respectively. Worthy of note is that the presence of zinc foil has a more positive effect on joint strength, which may be possibly attributed to more Cu-Zn intermetallic compounds (IMCs) formed at aluminum side instead of the appearance of more harmful Al-Cu IMCs.

Keywords: Friction stir brazing; Aluminum; Brass; Thermal history; Failure load; Intermetallic compounds

1.Introduction

In recent years, dissimilar joints have been increasingly applied in power generation, military uses, and electrical industries due to their technical and economic advantages [1-6]. The typical case was the joining between aluminum (Al) and brass (Br). On the one hand, both of these two alloys are excellent candidates for heat transfer systems and electrical applications due to their specific properties such as