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PII: S0264-1275(15)30721-8
DOI: doi: 10.1016/j.matdes.2015.10.144
Reference: JMADE 883

To appear in:

Received date: 23 June 2015
Revised date: 6 October 2015
Accepted date: 27 October 2015

Please cite this article as: Hong Ma, Guoliang Qin, Liyuan Wang, Xiangmeng Meng, Liang Chen, Effects of preheat treatment on microstructure evolution and properties of brazed-fusion welded joint of aluminum alloy to steel, (2015), doi: 10.1016/j.matdes.2015.10.144

Effects of preheat treatment on microstructure evolution and properties of brazed-fusion welded joint of aluminum alloy to steel

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Abstract: Microstructure and mechanical properties of brazed-fusion welded joint of aluminum alloy to galvanized steel were studied by analyzing and comparing the as-welded state and that with preheat treatment at different temperatures. The preheat treatment process not only increased the spreadability of weld seam and thickness of intermetallic compounds (IMCs) layer at brazed interface but also changed phase composition of IMCs layer. In as-welded joint, there were two IMCs layers (layer I included θ-Fe_4Al_{13} and τ_5-Al_8Fe_2Si adjacent to weld seam, and layer II was composed of η-Fe_2Al_5 near the steel side), while a newly formed nanoscale Fe-rich layer III which might consist of FeAl and Fe_3Al was found in the joint with preheat treatment, causing by interdiffusion between layer II and Fe at high temperature. Incomplete brazing at weld root deteriorated the strength of as-welded joint. The joint with preheat treatment at 100^{o}C, fractured at heat-affected zone on aluminum alloy side, exhibited the highest strength which reached nearly 80% of that of aluminum alloy. The thicker IMCs layer at weld root led to the fracture at brazed interface when preheat treatment at 200^{o}C.

Key words: Brazing-fusion welding; Preheat treatment; Intermetallic compounds; Mechanical properties

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