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Dissimilar Gas Tungsten Arc Weld-brazing of Al/Steel using Al-Si Filler Metal: Microstructure and Strengthening Mechanisms

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Abstract

In this paper gas tungsten arc welding (GTAW) was applied to dissimilar lap joining of Al6061 and Zn-coated galvanized low carbon steels using Al-5 wt.% Si filler metal. The joining mechanism was based on a hybrid brazing/welding mechanism. Three factors contributed to the joint strength including (i) low heat input rate of GTAW process which reduce the intermetallic compound layer growth during joining, (ii) the special role of Si in the filler metal which was able to change the nature of reaction layer from predominantly η -Al₅Fe₂ phase to predominately less brittle Al-Fe-Si phase and (iii) the flux-like action of Zn-coating which ensures complete wetting of steel surface by Al melt. It was found that there is a critical heat input when exceeded caused degradation of the mechanical strength of the joint due to increased intermetallic compound growth.

Keywords

Dissimilar welding, Aluminum, Steel, Intermetallic compound, Silicon, Zn-coating

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