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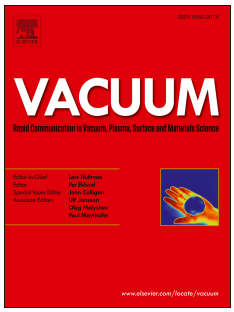

Influencing mechanism of Al–Zn coating addition on interfacial microstructure and mechanical property of vacuum electron beam welded Mg/steel joint

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Influencing mechanism of Al–Zn coating addition on interfacial microstructure and mechanical property of vacuum electron beam welded Mg/steel joint

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Abstract

The characteristics of vacuum electron beam welding (VEBW) of AZ31 Mg alloy (2.4 mm) to Q235 steel (2.0 mm) were investigated. The results showed that AZ31 and noncoated Q235 could not be joined together after VEBW. With an addition of Al-Zn coating, the lap joint of AZ31 and Q235 was obtained successfully. Firstly, the high amount of Al in the Al–Zn coating decreased the excessive vaporization of Zn. Secondly, the reasonable vaporization of Zn element and diffusion into the AZ31 of Al element in the coating improved the wettability of Mg/steel faying surface during the EBW process in vacuum conditions. Thirdly, the pre-existing Al–Fe intermetallic compound (IMC) was molten and kept at the Mg-steel interface, preventing a direct contact between molten Mg and steel during EBW. Subsequently, it formed an Al_5Fe_2 IMC layer, realizing the metallurgical bonding of AZ31 to Q235. The hardness testing indicated that the Al-Fe interface zone exhibited a peak in the hardness values. The average load of the AZ31/Al-Zn-coated Q235 joint with a width of 10 mm could reach 2.2 kN and the lap joint fractured at the faying surface between Al_5Fe_2 IMC layer and AZ31 substrate after tensile-shear testing.

***Keywords*:** Dissimilar metals; Metallurgical bonding; Al–Zn coating; Al_5Fe_2 IMC