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Influence of Ni coating on interfacial reactions and mechanical properties in laser welding-brazing of Mg/Ti butted joint

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Abstract

Laser welding-brazing characteristics of AZ31 Mg to Ti-6Al-4V in butt configuration without and with Ni coating was comparatively investigated with varied laser power. The interfacial reaction and mechanical properties were studied and the microstructure evolution mechanism was clarified based on thermodynamic calculation. The interfacial microstructure evolved from an ultra-thin Ti_3Al layer, to a layer of Ti_2Ni mingled with Ti_3Al, to Ti_3Al layer with increasing laser power. In addition, Ti_2Ni phase formed on Ti substrate at high laser power. The driving force of Al diffusing to Ti substrate was higher than that of Ni at low laser power while the diffusion time of Ni was longer, resulting in formation of Ti_3Al phase or mingled structure of Ti_3Al and Ti_2Ni at the interface. The driving force of Ni to Ti was larger than that of Al to Ti at high laser power, producing Ti_2Ni phase on Ti substrate. Mg-Al-Ni intermetallics formed in the fusion zone near the interface and became scattered with increasing laser power. The fracture load of Mg/Ni-coated Ti joint was approximately three times that of Mg/bare Ti joint. The Mg/Ni-coated Ti joint reached the maximum value of 3900