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The characteristics of laser welded magnesium alloy using silver nanoparticles as insert material

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ABSTRACT

This paper describes the characteristics of the laser welding of thin-sheet magnesium alloys using silver (Ag) nanoparticles as an insert material. The experiment was conducted using nanoparticles with 5 nm and 100 nm diameters that were welded with a Nd:YAG laser. The microstructure and mechanical properties of the specimens welded using inserts with different sizes of nanoparticles and without an insert material, were examined. Electron probe micro-analyzer (EPMA) analysis was conducted to confirm the existence of Ag in the welded area. The introduction of the Ag nanoparticle insert promoted large area of fine grain and broadened the acceptable range of scanning speed parameters compared to welds without an insert. Welds with 5 nm nanoparticles yielded the highest fracture load of up to 818 N while the lowest fracture load was found for weld specimens with 100 nm nanoparticles. This lower fracture load was due to larger voids and a smaller throat length, which contributed to a lower fracture load when using larger nanoparticles.

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