

PO1047

Surface modification of AZ91 magnesium alloy by high current pulsed electron beam treatment

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High current pulsed electron beam (HCPEB) treatment was conducted on AZ91 cast magnesium alloy with accelerating voltage 27 kV and energy density 3 J/cm^2 . The surface microstructure was characterized by optical microscope (OM), X-ray diffraction (XRD), scanning electron microscope (SEM) and transmission electron microscope (TEM). The surface microhardness was tested. It was found that the preferential evaporation of Mg element occurred on irradiated surface and the $\text{Mg}_{17}\text{Al}_{12}$ phases were dissolved in surface modified layer. The thickness of surface modified layer reached $\sim 8 \mu\text{m}$. The main phase composition in surface modified layer was changed as Mg-based supersaturated solution and noticeably increased $\text{Mg}_{17}\text{Al}_{12}$ phase. As a result, the surface microhardness was improved to 141 HK after 30 pulses of HCPEB treatment from the initial 62.7 HK.

Keywords

Surface modification

High current pulsed electron beam

AZ91 magnesium alloy

microstructure

microhardness