

Effects of Thermo-mechanical treatments on Mg-14Li-3Al-3Ce quaternary alloyC. O. Muga*¹ and Z. W. Zhang²

¹Physical Sciences Department, School of Pure and Applied Sciences, Machakos University, P.O. Box 136-90100, Machakos, Kenya.

²Key Laboratory of Superlight Materials and Surface Technology, Ministry of Education, College of Materials Science and Chemical Engineering, Harbin Engineering University, Harbin 150001, P R China.

ABSTRACT

We investigate the effects of aging and fast-cooling on the mechanical properties of Mg-14Li-3Al-3Ce alloy were investigated. Processing of aging and fast-cooling effectively refines microstructure and control the precipitation of intermetallics. Refined microstructures, enhanced tensile strengths and increased ductility were realized. Microstructures phase analysis depicts presence of dominant single coherent bcc β -phase and intermetallics. The as-cast Mg-14Li-3Al-3Ce alloy exhibits YS of 72.6 MPa, UTS of 104.3 MPa with ductility of 5.8%. Mg-14Li-3Al-3Ce alloys that were aged for longer hours show higher age-hardening response than the as-cast alloy. The alloy that was aged for 15 hours depicts YS of 105.5 MPa, UTS of 136.8 MPa and strain of 19.2%. Prolonged aging and fast-cooling activates grains/grain boundary refinement. The alloys exhibit high tensile strength after age-hardening response and fast-cooling processing. Precipitation of coherent bcc β -phase contributes to enhanced ductility where as intermetallics and strain aging enhances the tensile strength. Results revealed that fast-cooling enhanced Mg-14Li-3Al-3Ce alloys strength through grain refinement, crystallization and solid solution strengthening. We believe our findings could have profound impact to the materials and surface

Keywords: Mg-14Li-3Al-3Ce alloy, Aging, Fast-cooling, Mechanical properties, Technology, Community

*Corresponding author: Email: mugachalo@yahoo.com; Cell phone No: +254722243099 (Muga C.O.)