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Microstructure Study of Melt Spun $Mg_{65}Cu_{25}Y_{10}$

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Abstract : Magnesium alloys are characterized by good physical properties: They exhibit high strength, are lightweight and have good damping absorption and good thermal and electrical conductivity. Amorphous magnesium alloys, moreover, exhibit higher strength, hardness and a large elastic domain in addition to having excellent corrosion resistance. These above-mentioned advantages make magnesium based metallic glasses attractive for industrial use. Among the various existing magnesium alloys, $Mg_{65}Cu_{25}Y_{10}$ alloy is known to be one of the best glass formers. In the current study, $Mg_{65}Cu_{25}Y_{10}$ ribbons were produced by melt spinning, their microstructure was investigated in its as-cast condition, after pressing under 0.5 GPa for 5 minutes under different temperatures - RT, 500C, 1000C, 1500C and 2000C - and after five minute exposure to the above temperatures without pressing. The microstructure was characterized by means of X-ray Diffraction (XRD), Differential Scanning Calorimetry (DSC), High Resolution Scanning Electron Microscope (HRSEM) and High Resolution Transmission Electron Microscopy (HRTEM). XRD and DSC studies showed that the as-cast material had an amorphous character and that the material crystallized during exposure to temperature with or without applying stress. HRTEM revealed that the as-cast Mg65Cu25Y10, although known to be one of the best glass formers, is nano-crystalline rather than amorphous. The current study casts light on the question what an amorphous alloy is and whether there is any clear borderline between amorphous and nano-crystalline alloys.

Keywords : metallic glass, magnesium, melt spinning, amorphous alloys
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