Effects of magnesium on properties of alzrce-mg-al2o3 nanocomposites

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Aluminum alloy is one of the materials found in many applications, especially for electrical conductor materials. AlZrCe alloy reinforced by Al2O3 nanoparticles with Mg addition is proposed as one of the alternative materials to replace Aluminum Conductor Steel Reinforced (ACSR) as an aluminum conductor. Aluminum alloy Al-0.12%Zr-0.15%Ce as a master alloy was added with various weights of magnesium (Mg) from 2 to 5 wt% and was reinforced with 1.2% volume fraction of Al2O3 nanoparticles with particle sizes less than 80 nm. The molten metal matrix was blended with the reinforcement by a stirrer with a rotational speed of 500 rpm at a temperature of 750oC in an argon gas environment and casted by gravity casting. The objective of this research was to investigate the effect of magnesium on microstructural changes, electrical conductivity, and mechanical properties, such as tensile strength and hardness of the composites. The microstructure observation results showed that the greater the Mg content in composites up to 5%, the smaller the grain size of the composite matrix, wherein the grain size of the composite without Mg is 28 ?m, while the grain size of the composite with Mg of 2%, 3% and 5% are 27 ?m, 17 ?m and 9 ?m respectively. Similarly, tensile strength and hardness increased with increasing levels of Mg to 5% where the addition of 5% Mg, the tensile strength increased from 106 to 204 MPa and hardness increased from 30 to 68 BHN. In contrast, the electrical conductivity sharply decreased, due to the addition of Mg in the composite with a gradient of reduction, to 2.74% IACS (International Annealed Copper Standard) for every increasing 1% Mg. In which the electrical conductivity of the composite without Mg is 55.1% IACS and after adding 5 wt% Mg, it decreased to 41.3% IACS.