Abstract

An investigation is being carried out to determine the effect of varying Ni content on the Al-8Si-0.4Mg alloy and the effect of varying Si content on the Al-0.4Mg-Si-2Ni alloy. The following mechanical properties are studied: 1. Microstructure. 2. Hardness. 3. Tensile properties (ultimate tensile strength (UTS), yield strength (YS), % elongation (%EL)) 4. Wear rate. 5. CoF (Coefficient of friction) and 6. Hot tensile properties (UTS, YS, % EL). The type of the intermediate phase that forms during solidification in the Ni added and Si added alloys is investigated in this study. The Al-8Si-0.4Mg base alloy was melted in an electric furnace and Ni was added to the melt in the appropriate amount (2, 4, 6, 8 and 10 wt %). Similarly the Al-0.4Mg-Si-2Ni alloy was melted and Si was added to the melt in the appropriate amount (4, 8, 12 and 16 wt%). The melt was cast in a metal mould. Test specimens were solutionised at 537°C for 12 hrs. The water quenched specimens were then aged at 155°C for 3 hrs. The microstructure was observed for all the alloys, using both optical and SEM techniques. The phases present in the microstructure were identified using energy dispersive spectroscopy (EDS), X-ray diffractometry (XRD), TEM and SAED pattern analysis. The hardness was measured using a Vicker’s microhardness tester. The tensile specimens were machined from the heat treated bars as per ASTM E4 std. and tensile test was carried out on a universal testing machine. The wear test was carried out under dry sliding condition in air using a Ducom Pin-on-Disc wear testing unit. The tests were conducted as per ASTM G99 std. The eutectic Si morphology changed from elongated to particle shaped by the Ni addition. An intermediate phase Al3Ni was observed in the Ni and Si added alloys. The hardness and tensile properties increased and the wear rate decreased due to the presence of a second phase Al3Ni in the aged condition. The CoF remained the same for the Ni added and Si added alloys compared to the base alloy. Hot tensile strength of Al-8Si-0.4Mg alloy increased with increasing Ni addition and decreased with increasing test temperature. It is concluded that the Ni addition and Si addition significantly improves the properties of the base alloy.