ABSTRACT

Selected oxide particles that would react with aluminium were introduced into molten Al and Al-2Mg alloy in the range of 1 to 5 wt% by vortex method so as to react with the latter and to produce in-situ particulate composites. Particles were found to segregate at the top of the composite melt. In pure Al, TiO_2 particles reacted almost completely. Other oxides reacted partially, whereas ZnO remained almost unreacted in molten Al. α-Al_2O_3 was found to be formed alongwith pure metal and intermetallics in pure Al base composites. In Al-2Mg alloy melt, MnO_2 and V_2O_5 reacted completely, whereas other oxides reacted partially. The products of reaction were $MgAl_2O_4$ and MgO alongwith pure metals in some cases in Al-2Mg alloy base composites. Holding the pure Al base composites at 700^{o}C for 1 hr. did not result in further reactions.

The remelted composites were cast into graphite moulds. Reasonably uniform distribution of particles was observed in most of the cast composites. Voids were found to be present in the castings which resulted in the reduction of density of the composites. Appreciable increase in hardness and tensile strength was observed in pure Al-base composites with CuO, Fe_2O_3, TiO_2 and ZnO addition. In Al-2Mg alloy base composites, MnO_2, V_2O_5, Fe_2O_3, Cr_2O_3 and ZnO addition improved the hardness and tensile strength. Wear resistance of Al-2Mg alloy base composites was similar to that of the base metal.

Effect of hot working on the properties of pure Al base composites with 5 wt% CuO, MnO_2 and ZnO was studied. Hot working reduced the void fraction and improved density and hardness. Tensile strength of hot worked Al-5CuO composite showed improvement. After annealing tensile strength of all the composites improved as compared to that of annealed base metal.

Al-TiO_2 system was studied in more details. Segregation of particles at the top was utilized to produce composites with higher volume % of particles. Coarse particles were detected at the top whereas the fine particles were throughout. However mechanical properties of the top part after hot working was inferior probably due to presence of higher porisity % in that part.

The present work shows that preparation of in-situ particle composites is feasible with some improvement in mechanical properties.