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An effect of enhanced solid solubility on the microstructure and mechanical properties of Al-Cr solid solution by powder metallurgy process

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Abstract

Al-Cr alloys are usually used in home appliances, automotive, marine and aerospace applications as these possess superior properties like high strength-to-weight ratio, good corrosion resistance and workability. In Al-Cr alloys, chromium has severely limited strengthening effects due to its relatively low solid solubility in the aluminium matrix. The high content of chromium in Al matrix leads to the discontinuous precipitation with coarse Al_7Cr intermetallic phase. In this study, powder metallurgy (P/M) technique followed by microwave assisted sintering was adopted for the synthesis of $Al_{-x}Cr$ (x = 0, 2.5 and 5 wt%) alloys to enhance the solid solubility of Cr. Specimens were sintered at 560 ºC for one hour and cooled inside the microwave atmosphere. Sintered specimens were hot extruded and characterized in terms of the mechanical properties. Mechanical characterization showed that the addition of Cr as alloying element leads to an increase in microhardness, 0.2% tensile yield strength (TYS) and ultimate tensile strength (UTS) of the Al-alloy. However, the ductility of the Al-alloys was significantly decreased by the incorporation of Cr particulates in the aluminium matrix.

Keywords: Al-Cr system, powder metallurgy technique, hybrid microwave sintering, mechanical properties.