Abstract

2024 Al-Cu-Mg alloy offer high specific strength, good corrosion resistance and excellent fatigue resistance. These excellent properties make the 2024 alloy a very important alloy in the aerospace and automotive industry. However, the alloy suffer some problems during casting such as hot tearing, undesirable coarse dendrites structure and the presence of free impurity elements such as Fe and Si. These problems lead to deterioration in the mechanical properties of the alloy.

In the present study, the effect of Al-5%Ti-1%B master alloy additions and the rare earth cerium (Ce) with different additions (0.2 and 1% Ce) on microstructure and mechanical properties of 2024 alloy in different conditions (cast, homogenized and aged) was investigated. The microstructures of specimens were examined by optical microscope and scanning electron microscope (SEM) attached with EDS analyzer. It was found that Al-5%Ti-1%B and 0.2% Ce refine the microstructure; meanwhile, the 1% Ce addition increased the grain size again. The maximum refining obtained in this investigation is obtained by adding Al-5%Ti-1%B master alloy. A decrease in grain size from 81.5 µm to 30 µm was successfully achieved by these additions. The mechanical properties were determined by hardness and tensile tests. The mechanical properties were improved by the additions of Al-5%Ti-1%B master alloy and 0.2% Ce. A good combination of hardness, yield strength, ultimate tensile strength and elongation was obtained by means of Al-5%Ti-1%B additions. The percent increase is 20% for hardness, 104% for UTS, 71% for Y.S, meanwhile the elongation increased by 45.5%. On the other hand, with increasing the cerium content to 1% Ce, a drop in mechanical properties of the alloy was observed due to the appearance of eutectic lamellar structure (Al_3CeCu). Meanwhile, the peak aged condition does not recognized in this case.