TEM OBSERVATION OF HPT-PROCESSED Al-2.5Li(-2.0Cu) ALLOYS

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INTRODUCTION

Severe plastic deformation (SPD) processes attracted attention in recent years as a method of grain refinement. High-pressure torsion (HPT) process can introduce the large amount of strain continuously compared to other SPD processes. Al-Li alloys have low density and are strengthened by aging treatment. It is known that the addition of Cu to the Al-Li alloy precipitates the $T_1$ phase in addition to $\delta'$ phase. In this research, we examine how Cu addition to Al-Li binary alloy affects aging precipitation behavior after HPT processing.

EXPERIMENTAL METHOD

This study used disks with 10mm diameter of Al-2.7wt%Li alloy and Al-2.5wt%Li-2.0wt%Cu alloy. The discs were solution treated at 833K for 3.6 ks. The treated discs subjected to HPT under an applied pressure of 6GPa for 5 revolutions. Aging treatments were performed at 423K. The Micro Vickers hardness measurement was performed by using a load of 100g for 15 s. The microstructural observation used a TOPCON EM-002B transmission electron microscope (TEM) operating at 120kv.

RESULTS AND DISCUSSION

Figure 1 shows age-hardening curves of HPT-processed Al-Li(-Cu) alloys aged at 423K. Focusing on $a$sQ and $a$sHPT values, it can be seen that the hardness increased significantly by HPT processing. When subjected to the aging treatment, Al-Li binary alloy was not hardened, but the Cu added alloy showed the age hardening ability. Figure 2 shows TEM images of HPT processed Al-2.5Li-2.0Cu alloy aged at 423K for 60 ks. From (a), the average grain size is about 200 nm. From (b), spots of $T_1$ phase (Al₃LiCu) were observed in addition to Al matrix and $\delta'$ phase (Al₃Li). $T_1$ phase precipitated in addition to $\delta'$ phase, it contributed to the hardness increasing by Cu addition alloy.
Figure 1. Age-hardening curves of HPT-processed Al-Li(-Mg) alloys aged at 423K

Figure 2. TEM images of HPT processed Al-2.5Li-2.0Cu alloy aged at 423K for 60 ks

REFERENCES


KEYWORDS

Al alloy, HPT, TEM