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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 has 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 δ' 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 5revolutions. 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 asQ and asHPT 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 (Al_2LiCu) were observed in addition to Al matrix and δ' phase (Al_3Li). T_1 phase precipitated in addition to δ' phase, it contributed to the hardness increasing by Cu addition alloy.

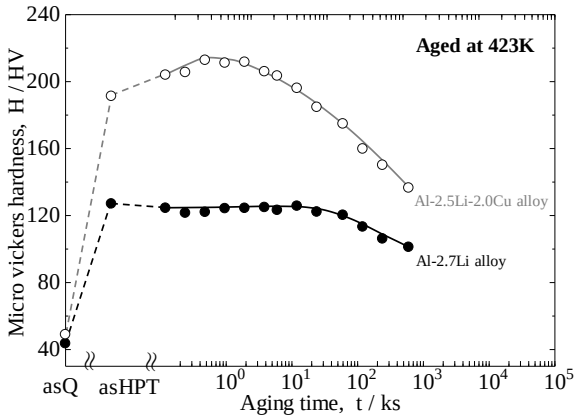

Figure 1. Age-hardening curves of HPT-processed Al-Li(-Mg) alloys aged at 423K

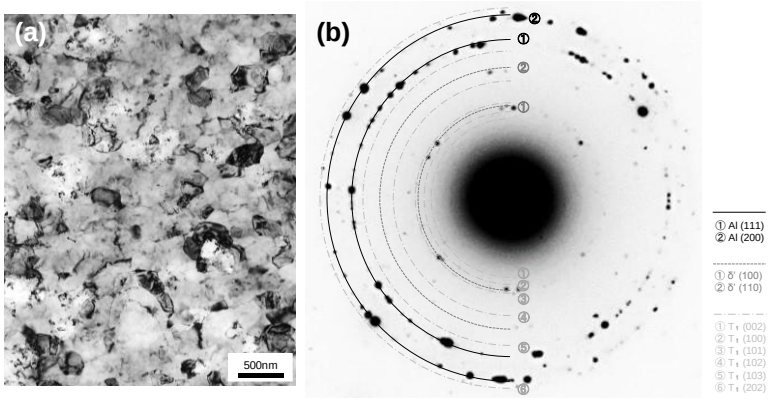

Figure 2. TEM images of HPT processed Al-2.5Li-2.0Cu alloy aged at 423K for 60 ks

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KEYWORDS

Al alloy, HPT, TEM