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Effect of Microstructure and Texture of Magnesium Alloy Due to Addition of Pb

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Abstract : Magnesium alloys were limited for industrial applications due to having a limited slip system and high plastic anisotropy. It has been known that specific textures were formed during processing (rolling, etc.), and These textures cause poor formability. To solve these problems, many researchers have studied controlling texture by adding rare-earth elements. However, the high cost limits their use; therefore, alternatives are needed to replace them. Although Pb addition doesn't directly improve magnesium properties, it has been known to suppress the diffusion of other alloying elements and reduce grain boundary energy. These characteristics are similar to the additions of rare-earth elements, and a similar texture behavior is expected as well. However, there is insufficient research on this. Therefore, this study investigates the behavior of texture and microstructure development after adding Pb to magnesium. This study compared and analyzed AZ61 alloy and Mg-15wt%Pb alloy to determine the effect of adding solute elements. The alloy was hot rolled and annealed to form a single phase and initial texture. Afterward, the specimen was set to contraction and elongate parallel to the rolling surface and the rolling direction and then subjected to high-temperature plane strain compression under the conditions of 723K and 0.05/s. Microstructural analysis and texture measurements were performed by SEM-EBSD. The peak stress in the true strain-stress curve after compression was higher in AZ61, but the shape of the flow curve was similar for both alloys. For both alloys, continuous dynamic recrystallization was confirmed to occur during the compression process. The basal texture developed parallel to the compressed surface, and the pole density was lower in the Mg-15wt%Pb alloy. It is confirmed that this change in behavior is because the orientation distribution of recrystallized grains has a more random orientation compared to the parent grains when Pb is added.

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