Low Temperature Ultrasonic Attenuation in Magnesium and Magnesium Alloys

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Abstract

The ultrasonic attenuation in pure Mg and Mg-Li and Mg-N alloys was studied in the temperature range from 4.2°K to 300°K. In Mg, four peaks were observed in the attenuation *vs* temperature curves. The peaks were named as P_1, P_2, P_3 and P_4 from the low temperature side. P_1 was observed at about 20°K and the origin of which was confirmed to be the interaction between sound waves and conduction electrons.

The activation energies of the relaxation processes accompanied with P_2 and P_3 were obtained as 0.009 eV and 0.09 eV, respectively. The ratio between the activation energies for P_2 and P_3 agrees well with that calculated from Seeger's theory making use of the values of the critical resolved shear stress for the basal slip and the non-basal slip. Therefore, the relaxation processes related to P_2 and P_3 are confirmed to be dislocation movements in the basal plane and in the non-basal plane, respectively.

In Mg-Li alloys, the activation energy increased for P_2 but decreased for P_3. In Mg-N alloys, the activation energy for P_2 was comparable with that of pure Mg.

The activation energy for P_4 was about 0.5 eV, and the value was considerably higher than that of the other peaks. Therefore, the origin of P_4 probably differs from that of the other peaks.

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