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COMMENTS ON A PAPER BY NO, ESNOUF, SAN JUAN, AND FONTOZZI

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Several years ago, Baik and Raj (1) presented a paper describing an internal friction study in an aluminum-5% magnesium alloy. They heated specimens in air to 583K and determined the grain boundary damping peak during cooling as a function of frequency followed by heating in vacuum to the same temperature and repeating the experiment. The grain boundary damping peaks were at 497, 529, and 546K for the specimen heated in air when tested at frequencies of 0.42, 0.74 and 2.15 Hz respectively, while the specimen heated in vacuum gave peaks at 481, 487, and 504K at frequencies of 0.29, 0.52, and 2.59 Hz.

To explain the differences between the temperature of the grain boundary damping peaks, Baik and Raj (1) concluded that the internal oxidation of copper (90 ppm) and iron (1.26×10^3 ppm) cause the shift of the peaks to a higher temperature while subsequent vacuum annealing causes the reduction of the oxides of iron and copper to the elements. Leighly (2) showed thermodynamically that aluminum is a very strong reducing agent, hence, iron and copper could not be oxidized in its presence. He pointed out that aluminum heated in air containing water vapor undergoes the reaction $2Al + 3H_2O \rightarrow Al_2O_3 + 6H$. The resulting hydrogen is capable of entering the metals as monatomic hydrogen. Gel'man <u>et al</u>. (3) showed that in aluminum heated in air saturated in water vapor at 293K (p_{H_2O} = 2.4 kPa), the solubility of hydrogen in the aluminum is roughly twice that observed for aluminum heated in dry hydrogen at 100 kPa (4).

Recently No <u>et al</u>. (5) reported a study of internal friction in high purity aluminum. In this research, they studied the internal friction in deformed specimens as they increased the test temperature. In some instances, they studied specimens that had been annealed at temperatures which would have produced equilibrium microstructures. Typical values of the peak temperature, P_1, are lowered by about 42K from the peaks for specimens heated in air by Baik and Raj (1). No <u>et al</u>. (5) showed that decreasing purity from 6N to 5N increased the peak temperature 40K (See Fig. 12, Ref. 5).

Nowhere in the paper by No <u>et al</u>. (5) is any mention made of the environment in which the aluminum was heated, nor is there any mention made of the state of the aluminum prior to the start of the experiment. Aluminum is quite notorious for picking up hydrogen and has a strong tendency to dissolve hydrogen produced by reacting with water vapor at high temperature. Unless the aluminum had been vacuum annealed before the beginning of the experiment and protected by a vacuum or inert atmosphere during high temperature annealing, hydrogen atoms will be present. These atoms will be trapped by defects. It has been shown that hydrogen inhibits vacancy migration (6). It is likely that the experimental data obtained by No <u>et al</u>. (5) has an undefinable factor in it due to interaction between defects and hydrogen atoms.

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