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Effect of Sc addition, friction stir processing, and T6 treatment on the damping and mechanical properties of 7055 Al alloy

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Abstract

Sc addition, friction stir processing (FSP), and subsequent solid-solution treatment and aging to peak hardness (T6 treatment) were applied on a 7055 Al alloy. Fine equiaxed grains were obtained after FSP, and the size of the grains was further refined by minor Sc addition. Subsequent solid-solution treatment led to the dissolution of η phase, and aging led to the precipitation of η′ phase in the FSP samples. The Al_3(Sc,Zr) particles effectively inhibited the grain coarsening in the Sc-containing FSP sample during the T6 process. Thus, a high density of η′ phase and a fine equiaxed grain structure were obtained in the Sc-containing 7055 alloy after FSP and T6 treatment. The special structure endowed this alloy with higher yield strength than the T6 treated 7055 alloy. FSP enhanced the high-temperature internal friction value of the Sc-containing 7055 alloy, and subsequent T6 treatment did not significantly reduce the value. The Sc-containing 7055 alloy exhibited greater high-temperature internal friction value than the T6 samples and the 7055 alloy fabricated using the same processing route.

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