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**Effect of electrical pulse treatment on the retrogression and re-aging behavior of 6061 aluminum alloy**

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**Abstract:**

Effect of electrical pulse treatment (EPT) on the retrogression and re-aging behavior of Al-Mg-Si based 6061 aluminum alloy was investigated by tensile tests, hardness measurement, differential scanning calorimetry (DSC) and transmission electron microscopy (TEM). The experimental results show that the electrical pulse treatment to the naturally aged 6061 alloy can induce the material strength decrease and Portevin–Le Chatelier (PLC) reappear simultaneously during tensile test. Especially, an electrical pulse with higher current density can produce stronger retrogression effect.

TEM results can't show obvious difference between naturally aged, electrical pulse treated, and as quenched 6061 alloy, but DSC test results can show obvious difference. The mechanism of precipitate evolution is discussed in sight of the dissolution of Mg-Si co-clusters inside during EPT process. TEM results also show that the re-aging behavior of pulses treated naturally aged 6061 alloy is caused by precipitation of needle-like precipitates during re-aging.

**Keywords:**

Aluminum alloys, Precipitate, Electrical pulse retrogression effect, Portevin–Le Chatelier (PLC) effect, Mg-Si co-clusters, Dissolution

**1. Introduction**

Al–Mg–Si alloys are widely used in industry due to attractive characteristics such as high ductility, high strength and age hardening capability[1], Their material strength evolution mainly depends on the precipitation of precipitates during natural aging or artificial aging. 6061 aluminum alloy is a common Al-Mg-Si aluminum alloys, it is extensively employed in marine frames, pipelines, storage tanks and aircraft applications, automotive parts[2]. The 6061-T4 Al-alloy is used in thin-walled tubes which are main specimens in the oxygen transportation and environmental control systems in aircraft[3].

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