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Thermomechanical pretreatment of Al-Zr-Mg-Cr alloy to improve the performance through creep-age forming

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Abstract

High-strength alloys are commonly treated with thermomechanical treatment to concurrently improve the alloy's forming and performance. Improved CAF processing method is presented in this research, which blends thermomechanical pre-treatment and CAF into a single process. CAF-treated Al–Zr–Mg–Cr alloys are projected to benefit from the suggested processing approach, which is expected to improve the alloy's forming efficiency and overall characteristics. This experiment looked at the creep-aging behaviour and characteristics of AA7475. Temperature mechanical pre-treatment causes more creep deformation than regression and re-aging or 3 percent pre-strain alone, according to the study's findings. Creep-aged materials with thermomechanical pre-treatment had mechanical, electrical, and erosion properties that were virtually equivalent to regression and re-aging-treated samples. In the creep-aged regression and re-aging pre-treatment sample, precipitates were observed at the coarse and discrete grain boundaries, as well as in the usual GP/phases and a 2-phase. Because of the reduced solute concentration in the matrix of the regression and re-aging pre-treatment sample, dislocations were able to move more easily, resulting in increased creep strain. This was more than made up for by the toughening effects of next stage and the hardening of disruptions. The thermomechanical pre-treatment procedure improves the creep forming and all the characteristics alloys comprising Al—Zr—Mg—Cr by providing an acceptable initial temper. The study's findings on Al–Zr–Mg–Cr alloys could boost CAF technology.

Introduction

Accurate large-scale components with complex geometries and high stiffness can be produced using the CAF process [1] used this method to produce the upper surface of the wing skins of the B-1B lengthy fighter planes and the Airlines A330/340/380 (2004). Al–Zr–Mg–Cr alloys are commonly used to manufacture these aviation components relatively dense and high heat treatment capabilities make them ideal [2]. Recent advances in ageing of AA7075, like T6 peak-aging state, have resulted in a reduction in strength of 10–15 percent, but an improvement in corrosion resistance, compared to T73 and T74 over-aging treatments, which coarsen intragranular precipitates [3], [4]. To further reduce corrosion susceptibility, the retrogression and re-aging (regression and re-aging) process has been extensively studied and has been proven to