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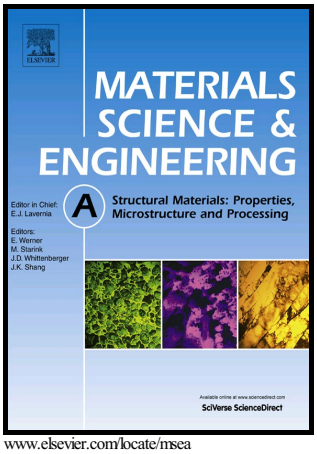

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Abstract

In the present study, elevated temperature deformation behavior and microstructural evolution of 7075 aluminum alloy at annealed and cold rolled conditions were examined. Isothermal uniaxial tensile tests at a temperature range of 200-350°C and at a strain rate range of 0.001-0.1s^{-1} were conducted to investigate the effects of deformation parameters on the mechanical behavior. High temperature flow was noticeably strain rate sensitive especially for the rolled condition. Cold work was shown to have a remarkable influence in increasing the peak stress up to 250°C. At and above this temperature the rolled microstructure enabled higher ductility reaching over 50% accompanied by a stress plateau. The ductility drop at 350°C at the slowest deformation rate was attributed to impurity rich regions with possible formation of secondary phases due to dynamic precipitation.

Keywords:

7075 aluminum alloy; Plastic deformation; High temperature forming; Rate sensitivity; Cold work; Fracture morphology

1. Introduction

Aluminum (Al) 7075, a high strength Al-Zn-Mg-Cu alloy, has been widely used in automobile, aerospace and transportation industries due to its noticeable room temperature strength to density ratio, fracture toughness and corrosion resistance [1, 2]. Structural alloys commonly exhibit decrease in the strength levels as the deformation temperature rises. In addition, demonstration of the microstructural evolution and failure mechanisms is especially important for metal forming processes. Therefore, investigation of the thermo-mechanical processing and mechanical behavior at elevated temperatures deserves attention as such there have been several studies concentrating on this topic for aluminum alloys [3-12].

Zhou et al. [3] recently studied the hot tensile deformation behavior of an Al-Zn-Mg-Cu alloy under the deformation temperature of 340–460^{o}C and strain rate of 0.01-0.001s^{-1}. The drop of flow stress levels was explained by either the increase of deformation temperature or the decrease of strain rate. Moreover, hot ductility of this alloy has been studied both in tension and compression at various temperatures [4]. Enhancement of ductility with the ascent of the deformation temperature was the crucial finding of this work. Additionally, Jiménez et al. [5]