Superplasticity in high temperature magnesium alloy WE43

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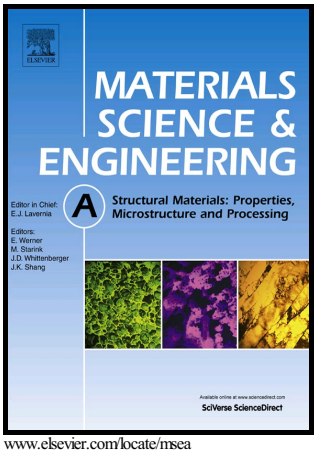

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Abstract

Severe plastic deformation of the magnesium alloy WE43 (Mg-4%Y-2.3%Nd-0.5%Zr) has been carried out by multi-axial forging (MAF) in order to refine the grain size from 25 μm to 6 μm. Deformation behaviour of the as-processed material has been investigated. Compression tests were carried out in the temperature range 250 - 450 °C and in the strain rate range 10^{-3}-10 s^{-1}. Strain-rate sensitivity values were calculated from the stress-strain curves. A high value of strain rate sensitivity was noticed in the temperature range 350 - 400°C and the strain rate range 10^{-4}- $10^{-2}s^{-1}$, which indicated the possibility of superplastic forming after multi-axial forging. The superplastic behaviour of MAF processed samples was further investigated by carrying out tensile tests. An excellent superplastic elongation of 470% was obtained at the temperature 375°C and strain rate $3*10^{-4}s^{-1}$. The material also exhibited superplasticity at higher strain rates at this temperature.

Keywords: Magnesium alloy; severe plastic deformation; multi axial forging; strain rate sensitivity; superplasticity; grain boundary sliding.