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AN EVALUATION OF SUPERPLASTIC FLOW IN ULTRAFINE-GRAINED MATERIALS PROCESSED USING SEVERE PLASTIC DEFORMATION

Megumi Kawasaki[1]
Terence Langdon[1]

Abstract

The introduction of significant grain refinement is very attractive because small grains will produce excellent creep properties especially superplastic ductilities at elevated temperatures. Since the strain rate in superplastic flow varies inversely with the grain size raised to a power of two, a reduction in grain size to the submicrometer level will lead to the occurrence of superplasticity within the region of high strain rate superplasticity at strain rates $>10^{-2}$ s^{-1}. In the present report, published creep data are analyzed for several different ultrafine-grained materials processed by equal-channel angular pressing. The analysis shows the results from all materials are mutually consistent and there is very good agreement with a flow mechanism developed earlier to explain superplastic flow in conventional materials with coarse grains.

[1] *University of Southern California.*