Creep in alumina and carbon nanotube reinforced alumina composites

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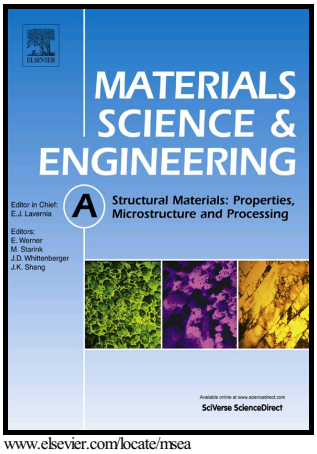

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Abstract

Despite numerous studies over five decades, the mechanism controlling creep in fine grained alumina has not yet been identified unambiguously. Compression creep experiments in alumina and carbon nanotubes (CNTs) reinforced alumina composites reveal that the creep at high stresses is not influenced by the presence of CNTs at grain boundaries. All data at high stresses are consistent with a Coble diffusion creep mechanism and a stress exponent of one, and an interface controlled diffusion creep process at lower stresses with a stress exponent greater than one. This is similar to earlier observations in fine grained yttria stabilized tetragonal zirconia. Based on a recent study on Al tracer grain boundary diffusion, analysis of the data in terms of cation and anion diffusion along grain boundaries suggests that creep is controlled by the slower O diffusion along grain boundaries.

Keywords: alumina, carbon nanotubes, composite, creep, diffusion

1. Introduction

Alumina has been studied for over five decades as a standard oxide ceramic for critically evaluating many models for sintering and high temperature creep [1-5].

Conventionally, creep of materials is studied as follows: