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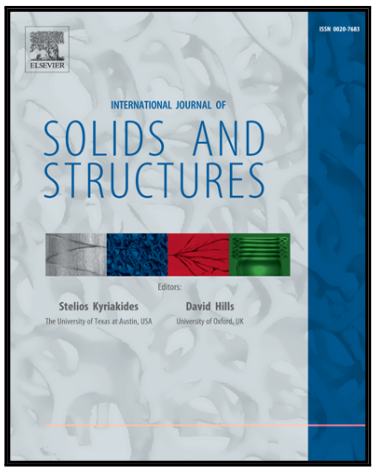

Finite element analysis of the damage and healing behavior of self-healing ceramic materials

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Finite element analysis of the damage and healing behavior of self-healing ceramic materials

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Abstract

Self-healing of crack-damaged brittle ceramics is a valuable phenomenon that counteracts the reliability decrease caused by undesired cracking during service. In this study, we developed a constitutive model to analyse the behavior of self-healing ceramic materials within the framework of a finite element method (FEM), which can describe not only an isotropic damage process under specific boundary conditions, but also self-healing at high temperatures and O_2 partial pressures. The damage process was formulated based on the fracture mechanics, while self-healing was described using oxidation kinetics modelling of self-healing time. In addition, the proposed constitutive model was applied to a FE analysis of alumina/15 vol.% SiC nanocomposite materials.

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