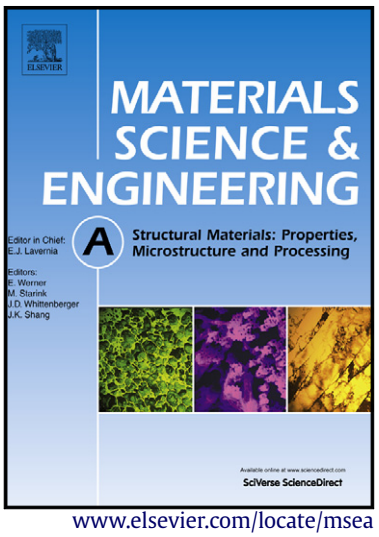

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Multi-scale simulation of the tensile properties of fiber-reinforced silica aerogel composites

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Abstract

A new multi-scale model is proposed to investigate the relationship between the mechanical properties and microstructure of fiber-reinforced silica aerogel composites. The multi-scale model consists of the aerogel model in nanometers and the composite model in micrometers. The aerogel model is generated to represent the cluster structure of silica aerogels based on a modified diffusion-limited cluster aggregation (DLCA) algorithm, in which the size-dependent interactions between the primary particles are obtained from theoretical derivations. A continuum damage constitutive model is established to represent the behavior of the silica aerogel matrix in the composite by implementing the aerogel model with the discrete element method (DEM). After that, a modified embedded element technique (EET) is proposed to