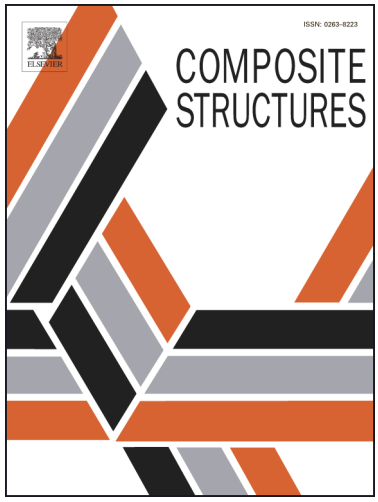


# RVE Model with Shape and Position Defects for Predicting Mechanical Properties of 3D Braided CVI-$SiC_f$/SiC Composites

Xiuli Shen, Xin Liu, Shaojing Dong, Longdong Gong

PII: S0263-8223(17)34296-4
DOI: https://doi.org/10.1016/j.compstruct.2018.04.074
Reference: COST 9628

To appear in: *Composite Structures*

Received Date: 22 December 2017
Revised Date: 10 April 2018
Accepted Date: 26 April 2018

Please cite this article as: Shen, X., Liu, X., Dong, S., Gong, L., RVE Model with Shape and Position Defects for Predicting Mechanical Properties of 3D Braided CVI-$SiC_f$/SiC Composites, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.04.074

# RVE Model with Shape and Position Defects for Predicting Mechanical Properties of 3D Braided CVI-$SiC_f$/SiC Composites

**Xiuli SHEN[a], Xin LIU[a], Shaojing DONG[a *], Longdong GONG[b]**

[a]*School of Energy and Power Engineering, Beihang University, Beijing 100083, China*

[b]*Navigation and Control Technology Research Institute of China Ordnance Industries, Beijing 100089, China*

**Contact information for the corresponding author Shaojing Dong:**

Address: Beihang University, Beijing 100191, China. Tel: 13811081511. E-mail: dshj0321@163.com.

## Abstract

A representative volume element (RVE) model with internal shape and position defects for 3D braided chemical vapor infiltration (CVI) $SiC_f$/SiC ceramic matrix composite (CMC) is developed and its mechanical properties were analyzed with finite element method. According to the characteristics of precast braiding and CVI deposition, it is assumed that the rate of deposition in each direction along the surface of the fiber bundle is similar. The $SiC_f$/SiC-CMC samples were divided while the characteristic parameters of RVE model were measured from scanning electron microscope (SEM) images. The RVE model is established from the micro-geometric parameters. The naturally formed porous structure accurately represents the internally defective geometric shape and position. The relative errors of the calculated tensile modulus and Poisson's ratio are within 5% compared to the observed mechanical properties of material. It shows that the RVE model and simulation methods are realistic and accurate. Finally, the established RVE model is compared with randomly distributed defective RVE model for the prediction of mechanical properties. And the applicability of RVE model with shape and position defects is studied by comparison with microscopic structure of the material in SEM images.

**Keywords:** $SiC_f$/SiC ceramic matrix composites; Representative volume element; Chemical vapor infiltration; Defects; Mechanical properties