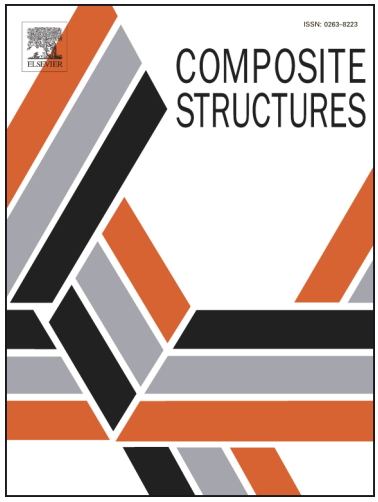

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Influence of the size and boundary conditions on the predicted effective strengths of particulate reinforced metal matrix composites (PRMMCs)

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Abstract

Understanding how the load bearing capacity of particulate reinforced metal matrix composite (PRMMC) is related to the underlying microstructure is essential for developing new PRMMC materials. In a recent study, we presented a numerical technique which combines the homogenization technique, direct method, and statistical analyses. By using this approach, ultimate strength and endurance limit of the PRMMCs can be predicted from the composite microstructure in the mesoscale. Because PRMMCs are typical random heterogeneous materials, the size of RVE models, as well as boundary conditions, have been acknowledged to have nontrivial influence over the predicted effective behavior. In this paper, the objective is to understand how the strength predicted from the direct method is influenced by the RVE size and boundary condition. Because in our previous study it has already been shown that homogenization results are insensitive to boundary conditions applied on the RVE, the focus of the present paper is laid on the influence of the embedded cell model. In order to capture the influence of RVE size and embedded cell configuration, an exemplary PRMMC material, WC- 20 Wt.% Co, was selected. A great number of representative volume elements (RVE) models were built as artificial microstructures of this material. By analyzing the effective behaviors, especially the strength, predicted from these samples from a statistical point of view, the influence of the boundary condition and the size effect were revealed. On that basis, this study proposes a feasible

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