Theoretical prediction on temperature-dependent non-steady-state first matrix cracking stress for fiber reinforced ceramic composites

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Abstract

Based on a kind of equivalence between the shear strain energy and the corresponding heat energy, a temperature-dependent interfacial shear strength model for fiber reinforced ceramic composites is developed. Afterwards, based on the proposed interfacial shear strength model and fracture mechanics analysis, a temperature-dependent non-steady-state first matrix cracking stress model is established. The combined effects of temperature, crack length and residual thermal stress are included in the model. Good agreement between the model predictions and the experimental data of SiC fiber reinforced zircon matrix composite is obtained. The predictions of the model are also compared with the predictions of existing models based on fracture mechanics analysis. It shows that our model has obvious advantages compared to the existing models from the aspects of convenience, applicability and accuracy.

Keywords: Temperature-dependent; First matrix cracking Stress; Non-steady-state; Fiber reinforced ceramic composites