Determining fracture strength and critical flaw of the ZrB_2–SiC composites on high temperature oxidation using theoretical method

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Abstract

In this work, based on the Griffith energy method and the sensitivities of the thermal-physical properties of materials to temperature, a theoretical method for studying the temperature dependent fracture strength and critical flaw size of the ZrB_2–SiC composites on high temperature oxidation is proposed by using a temperature dependent fracture surface energy model. The combined effects of temperature, microstructure and oxidation damage are taken into account by this method. The method can be easily used to predict fracture strength of the composites and its key control mechanism by using some basic material parameters. The predictions are in good agreement with experimental reports. The theoretical method can become a potential convenient and practical technical means for determining temperature and oxidation dependent fracture strength and critical flaw of the ZrB_2-SiC composites developed for aerospace applications related to hypersonic flight.

Keywords: A. Ceramic–matrix composites (CMCs); B. Fracture; B. High–temperature properties; C. Analytical modeling