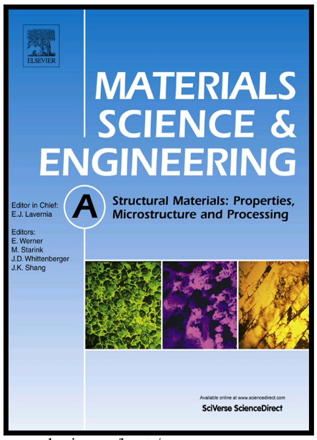

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Jiten Das, B Chenna kesava, J Janardhana Reddy, V Srinivas, Sweety Kumari, V V Bhanu Prasad

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Microstructure, mechanical properties and oxidation behavior of short carbon fiber reinforced ZrB_2-20v/oSiC-2v/oB_4C composite

Jiten Das*, B Chenna kesava[1], J Janardhana Reddy, V Srinivas, Sweety Kumari, V V Bhanu Prasad

Defence Metallurgical Research Laboratory, Hyderabad, India
*
*Corresponding author; Email id : dasjiten@rediffmail.com

Abstract

Present study aims at observing the effect of short carbon fiber addition on the microstructure, mechanical properties and oxidation behavior of the ZrB_2-20v/oSiC-2v/oB_4C composite. Microstructure of the composite shows uniformly distributed SiC particles along with the occasional presence of short carbon fiber and B_4C particles in the ZrB_2 matrix. Carbon fiber addition leads to refinement of both ZrB_2 and SiC grains. Both the flexural strength and maximum strain value of carbon fiber reinforced ZrB_2-20v/oSiC-2v/oB_4C composite is observed to be higher than those of the base i.e. ZrB_2-20v/oSiC-2v/oB_4C composite. Although the fracture toughness of the composite improves, hardness of the composite does not change significantly due to addition of carbon fiber. After the oxidation treatment in air furnace at 1600°C for 2h, the carbon fiber reinforced composite shows formation of SiO_2 rich, continuous and protective top layer of about 30 μm, ZrO_2+SiO_2-middle layer of about 80-90μm and a relatively thin SiC depleted layer (~100μm). On the other hand, the base composite shows the formation of a discontinuous SiO_2-rich top layer of about 20-30 μm, ZrO_2+SiO_2-middle layer of about 60-70 μm, and a thick (~200 μm) and cracked SiC depleted layer after the same oxidation treatment. Hardness deterioration is not observed beneath the oxide layer including SiC depleted region in case of carbon fiber reinforced composite, while a slight deterioration is observed in the base composite. Thermal diffusivity of the carbon fiber reinforced ZrB_2-20v/oSiC-2v/oB_4C composite is observed to be slightly lower than that of the base ZrB_2-20v/oSiC-2v/oB_4C composite.

Keywords: Short carbon fiber, ZrB_2-SiC composite, fracture toughness, oxidation behaviour

Introduction

Because of their extremely high melting points, oxides, borides, carbides and nitrides of transition metals (Ti, Zr, Hf, Nb, Ta) are considered as high temperature materials **[1].** However, the borides of transition metals (Ti, Zr, Hf, Nb, Ta) are considered more superior amongst all those mentioned above due to their superior thermal shock and creep resistance as well as ~~and~~ thermal conductivities. Especially ZrB_2 and HfB_2 show best high temperature oxidation

[1] Andhra Univrsity, Visakhapatnam, India