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Preparation and mechanical properties of $\text{Ti}_3\text{SiC}_2/\text{SiC}$ functionally graded materials

Yanzhi Cai^{a*}, Laifei Cheng^b, Hongfeng Yin^a, Xiaowei Yin^b, Yangli Tian^a, Jinxue Chen^a,
Nan Wang^a

^aCollege of Materials and Mineral Resources, Xi'an University of Architecture and Technology, Xi'an, Shaanxi, 710055, P. R. China

^bScience and Technology on Thermostructure Composite Materials Laboratory, Northwestern Polytechnical University, Xi'an, Shaanxi, 710072, P. R. China

*Corresponding author. Tel./Fax: +86 29 82205245. caiyanzhi@xauat.edu.cn (Yanzhi Cai)

Abstract

$\text{Ti}_3\text{SiC}_2/\text{SiC}$ functionally graded materials (FGMs) were prepared via hot-pressing sintering followed by positioning impregnation. Positioning impregnation is a novel technique for local impregnation targeted at graded layers that exhibit poor sintering behaviour. The positioning impregnation process significantly densified layers with SiC volume fractions of more than 70% while only slightly affecting the densities of the other layers and preserving sufficiently weak interfaces between layers. FGMs that were hot pressed at 1600 and 1700 °C and then subjected to impregnation showed not only high flexural strengths but also zigzag load-displacement behaviour. The flexural strengths of these FGMs were 436 and 485 MPa, respectively; in comparison, the values for the FGMs without impregnation that were hot pressed at 1600, 1700 and 1800 °C were 235, 268 and 328 MPa, respectively. Moreover, the fracture toughnesses of these FGMs were 8.23 and 7.15 $\text{MPa m}^{1/2}$, respectively; in comparison, the values for the FGMs without impregnation that were hot pressed at 1600, 1700 and 1800 °C were 6.77, 7.05 and 4.65 $\text{MPa m}^{1/2}$, respectively.

Keywords: A. Positioning impregnation; B. Composites; B. Interfaces; C. Mechanical properties; D. SiC

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