中国有色金属学报
中国有色金属学报(英文版)
中国科学技术协会 主管
中国有色金属学会 主办

论文摘要

中国有色金属学报
ZHONGGUO YOUSEJINSHUXUEBAO XUEBAO
第18卷 第2期 (总第107期) 2008年3月

[PDF全文下载]

文章编号：1004-0609(2008)02-0271-07

热压C-SiC-B4C-TiB2复合材料的组织与力学性能

喻 亮，茹红强，蔡继东，杨 超，左 良，薛向欣

(东北大学 材料各向异性与织构教育部重点实验室，沈阳 110004)

摘 要：以磷片石墨C_{fg}，SiC，B_4C和TiO_2为原料，热压合成C-SiC-B_4C-TiB_2复合材料，研究不同C_{fg}含量和热压温度对复合材料显微组织和力学性能的影响规律。结果表明：烧结过程中TiO_2与B_4C反应原位生成TiB_2；复合材料的密度和抗弯强度随着热压温度的升高而增加，却随着C_{fg}含量的增加而降低，随着热压温度的升高和C_{fg}含量的增加，复合材料的断裂韧性则提高；在2 000 ℃，25 MPa下热压时，C_{fg}含量为20%(质量分数)的复合材料其体积密度为2.81 g/cm^3，抗弯强度为236.7 MPa，断裂韧性为5.3 MPa·m$^{1/2}$，C_{fg}含量为65%含量的复合材料的体积密度为2.42 g/cm^3、抗弯强度为103.6 MPa、断裂韧性为8.1 MPa·m$^{1/2}$；复合材料的致密化程度和陶瓷晶粒随热压温度的升高而增大，复合材料中C_{fg}层状分布结构随C_{fg}含量的增加更加明显；复合材料中C_{fg}弱界面分层诱导韧化作用及第二相TiB_2和陶瓷基体热膨胀系数不匹配所产生的残余应力导致的裂纹偏转作用是复合材料断裂韧性提高的主要原因。

关键字： C-SiC-B4C-TiB2复合材料；热压；显微组织；力学性能

Microstructure and mechanical properties of hot pressed C-SiC-B4C-TiB2 composites

YU Liang, RU Hong-qiang, CAI Ji-dong, YANG Chao, ZUO Liang, XUE Xiang-xin

（Key Laboratory for Anisotropy and Texture of Materials, Ministry of Education, Northeastern University, Shenyang 110004, China）

Abstract: C-SiC-B4C-TiB2 composites were prepared with raw materials such as flake graphite Cfg, SiC, B4C and TiO2 by in situ synthesis and hot pressed. The effects of Cfg content, sintering temperatures on the microscope structure and mechanical properties of composites were studied. The results show that TiB2 particles form by the reaction of TiO2 and B4C in the composite in the sintering process. The density and flexure strength increase with increasing sintering temperature, while decrease with increasing Cfg content. The fracture toughness increases with increasing sintering temperature and Cfg content. The density, flexure strength and fracture toughness of the composite is 2.81 g/cm3, 236.7 MPa, 5.3 MPa·m1/2 with 20%Cfg(mass fraction) at 2 000 ℃ and 25 MPa, as well as 2.42 g/cm3, 103.6 MPa, 8.1 MPa·m1/2 with 65% Cfg at 2 000 ℃ and 25 MPa. The pyknosis degree increases and the ceramic crystal grains of the composites grow up with

increasing sintering temperature, Cfg layers structure of the composites become clearly with increasing Cfg content. It is found that the toughning mechanism of the composites is mainly that the lamination between Cfg and ceramic phase, which results in the toughening effect induced by the lamination of weak crystal boundary, and the thermal stress due to the heat expansion mismatching between ceramic phase and the second phase TiB2 leads to the heat stress micro crack deflection in the composites.

Key words: C-SiC-B4C-TiB2 composite; hot pressed; microstructure; mechanical property