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原位反应结合碳化硅多孔陶瓷的制备与性能

丁书强[1,2], 曾宇平[1], 江东亮[1]

1. 中国科学院上海硅酸盐研究所结构陶瓷工程中心, 上海 200050; 2. 中国科学院研究生院, 北京 100049

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摘要 以碳化硅(SiC)和氧化铝(Al_2O_3)为起始原料、石墨为造孔剂, 通过原位反应结合工艺制备SiC多孔陶瓷. XRD分析表明多孔陶瓷的主相是SiC, 结合相是莫来石与方石英; SEM观察到多孔陶瓷具有相互连通的开孔结构. 坯体在烧结前后具有很小的尺寸变化, 线收缩率约在±1.5%内. 多孔陶瓷的开口孔隙率随烧结温度和成型压力的增大而减小, 随石墨加入量的增加而增大; 而体密度具有相反的变化趋势. 随着石墨粒径的增大, 多孔陶瓷的孔径分布呈现双峰分布. 抗弯强度随烧结温度和成型压力的增大而增大, 随石墨加入量的增大而减小. 于1450℃保温4h烧成的样品在0～800℃的平均热膨胀系数为6.4×10^{-6}/K. 多孔陶瓷还表现出良好的透气性、抗高温氧化和耐酸腐蚀性, 但耐碱腐蚀性相对较差.

关键词 碳化硅多孔陶瓷 反应结合 孔隙率 强度

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Preparation and Properties of In~Situ Reaction Bonded Porous SiC Ceramics

DING Shu-Qiang [1,2], ZENG Yu-Ping[1], JIANG Dong-Liang[1]

1. Structural Ceramics Engineering Center of Shanghai Institute of Ceramics, Chinese Academy of Sciences, Shanghai 200050, China; 2. Graduate University of Chinese Academy of Sciences, Beijing 100049, China

Abstract An in situ reaction-bonding technique was developed to fabricate porous silicon carbide (SiC) ceramics in air from SiC and Al_2O_3, using graphite as the pore former. The main phase is SiC and the bonded phases are mullite and cristobalite in porous SiC ceramics. The reaction-bonded SiC ceramics possess connected open pores. The linear shrinkage of the specimens before and after sintering is between --1.5% and +1.5%. Open porosity decreases with the sintering temperature and forming pressure, but increases with the graphite content. Bulk density and mechanical strength increase with sintering temperature and forming pressure, but decrease with the graphite content. The pore size distribution takes on a bimodal distribution when the graphite particle size is 20.0μm. In addition, as-fabricated porous SiC ceramics exhibit low coefficient of thermal expansion, high N_2 permeability, excellent high temperature-oxidation resistance, good acid endurance and relatively bad alkaline endurance.

Key words porous SiC ceramics reaction bonding porosity strength

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通讯作者 曾宇平 yping-zeng@mail.sic.ac.cn