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论文

# 超重力下燃烧合成$TiB_2$-TiC共晶复合陶瓷

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摘要：

采用超重力下燃烧合成技术，制备出$TiB_2$-TiC共晶复合陶瓷。XRD、SEM与EDS结果表明，复合陶瓷主要由大量细小的TiB 2片晶均匀分布于TiC基体上的共晶组织构成，而富钛ε碳化物(Ti，Cr)$C_{1-x}$则断续分布于TiC基体间，同时在基体中还孤立分布着少量的、形态不规则的α-$Al_2O_3$晶粒或$Al_2O_3$-$ZrO_2$共晶团组织。高温化学反应使所有产物均呈液态，且超重力的引入诱发熔体内部Stocks流，从而获得液态Ti-Cr-C-B与液态氧化物的分层熔体，液态Ti-Cr-C-B在远离平衡态下发生共晶反应生成TiB 2 2TiC共晶复合陶瓷。性能测试表明，随着$B_4C$ + Ti + C在燃烧体系中质量分数增加，$TiB_2$-TiC共晶复合陶瓷相对密度和断裂韧性变化不大，分别为97 %～99 %与6. 5～7. 1 MPa·$m^{1/2}$，而维氏硬度与弯曲强度则逐渐增加，最高可达28. 6 GPa与615 MPa。

关键词： $TiB_2$-TiC复合陶瓷 燃烧合成 超重力 快速凝固 共晶转变

# $TiB_2$-TiC eutectic composite ceramics prepared by combustion synthesis under high gravity

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Abstract:

$TiB_2$-TiC eutectic composite ceramics were prepared by combustion synthesis under high gravity. XRD ,SEM and EDS results show that $TiB_2$-TiC composites are mainly composed of the eutectic microst ructures of TiC matrix, in which a large number of the fine $TiB_2$ platelet grains are dispersed uniformly ; meanwhile, at the boundaries of the eutectic microst ructures there discontinuously disperse the ε-carbides with the enrichment of Tiatoms, and a few of isolated , irregular α-$Al_2O_3$ grains and $Al_2O_3$-$ZrO_2$ colonies are also observed. Because high-temperature chemical reaction results in the full-liquid products, and the introduction of high gravity induces the Stocks flow in the melts, leading to the formation of layered melt s consisting of liquid Ti-Cr-C-B and liquid oxides, it is considered that $TiB_2$-TiC composites grow through eutectic t ransformation far away f rom the equilibrium state.The results of properties indicate that with increasing mass fraction of $B_4C$ + Ti + C in combustion systems , the relative density and f racture toughness of $TiB_2$-TiC composites are all among 97 %～99 % and 6. 5 ～7. 1 MPa·$m^{1/2}$ , respectively, and the Vickers hardness and flexural strength are increased gradually to the maximum values of 28. 6 GPa and 615 MPa, respectively.

Keywords: $TiB_2$-TiC composite ceramics combustion synthesis high gravity rapid solidification eutectic transformation

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