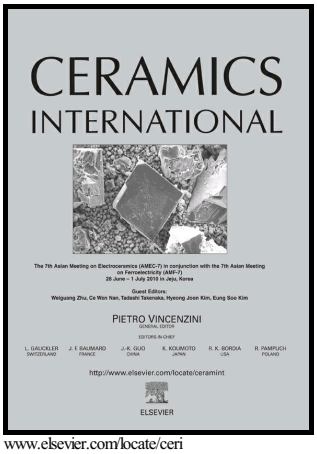

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Mechanical properties and thermal shock resistance of Si_2BC_3N ceramics with ternary Al_4SiC_4 additive

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Abstract

Dense Si_2BC_3N ceramics were prepared through SPS sintering the amorphous Si_2BC_3N and Al_4SiC_4 powders obtained from mechanical alloying. The phase compositions, microstructures, and mechanical properties, as well as the thermal shock resistance were investigated. In addition, evaluations of oxidation and the ablation resistance were also preceded. The results show that Al_4SiC_4 phase can be detected at 1200 and 1400 ℃ under pressureless sintering. However, Al_4SiC_4 can be decomposed to AlN and SiC phases under higher temperatures. As for the bulk Si_2BC_3N ceramics, the Al_4SiC_4 additive induce the development of turbostratic BN(C) plates and improve the relative density consequently. Besides, the Al_4SiC_4 plates are embedded in the matrix of ceramics. Therefore, the mechanical properties and thermal shock resistance are improved apparently with the addition of additive. Meanwhile, the additive containing composites have superior ablation resistance than the pristine Si_2BC_3N ceramics due to their higher relative density.

Keywords: Si_2BC_3N ceramics; Al_4SiC_4; Mechanical properties; Thermal shock; Ablation resistance

1. Introduction

Ultra-high temperature SiBCN ceramics have attracted intensive attentions due to their extraordinary high temperature stability up to 2000 ℃ without apparent decomposition, which made them one of the state-of-the-art structure ceramics [1-3]. Up to date, the mechanical alloying (MA) has been successfully applied to fabricate SiC [4-5], Si_3N_4-SiC [6], and BCN [7-8] during the last decades. In fact, we have also synthesized amorphous SiBCN with this method and the sintered bulk SiBCN ceramics showed good oxidation resistance and thermal stability [9-14].