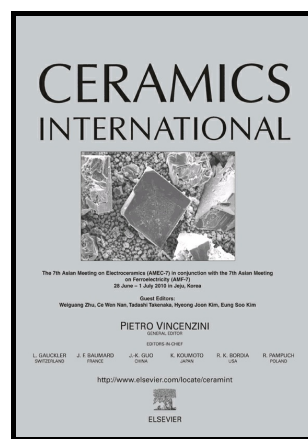


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## The effect of TiO<sub>2</sub> additive on sinterability and properties of SiC-Al<sub>2</sub>O<sub>3</sub>-Y<sub>2</sub>O<sub>3</sub> composite system

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### Abstract

In the current research, the effects of TiO<sub>2</sub> additive on mechanical and physical properties of SiC bodies, sintered by liquid phase methods were investigated. Al<sub>2</sub>O<sub>3</sub> and Y<sub>2</sub>O<sub>3</sub> were used as sintering-aids (10 wt. % in total) with an Al<sub>2</sub>O<sub>3</sub>/Y<sub>2</sub>O<sub>3</sub> ratio of 43/57 to provide liquid phase during Sintering. TiO<sub>2</sub> was also used as the oxide additive with an amount ranging from 0 to 10 wt. %. After scaling and mixing the starting materials by a planetary mill, the obtained slurry was dried at 100 °C for four hours. The derived powders were finally pressed under a pressure of 90 MPa. The samples were then pyrolyzed and sintered at 600 °C and 1900 °C, respectively under argon atmosphere for 1.5 hours. Phase analysis showed no trace of TiO<sub>2</sub> after the sintering process, demonstrating the complete TiO<sub>2</sub> to TiC transformation. The results showed that an increase in TiO<sub>2</sub> content up to 5 wt. %, led an improvement in all the measured properties including the relative density, hardness, Young's modulus, bending strength, indentation fracture resistance and the brittleness factor, reaching to 96.2%, 24.4 GPa, 395.8 GPa, 521 MPa, 5.8 MPa.m<sup>1/2</sup> and 286.5 ×10<sup>-6</sup> m<sup>-1</sup>, respectively. However more than 5 wt. % additive resulted in a decrease in all the above-mentioned properties. Microstructural studies demonstrated that crack deflection and crack bridging were the major mechanisms responsible for an increase in the indentation fracture resistance.

**Keywords:** SiC-TiC composite; TiO<sub>2</sub> additive; Bending strength; Indentation fracture resistance; Hardness.

### I. Introduction

Silicon carbide (SiC) is an important structural material. This material has found a wide range of applications including wear-resistant parts, refractories, electronic equipment, high-

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