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## Effect of temperature and pre-sintering on phase transformation, texture and mechanical properties of silicon nitride ceramics

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### Abstract

Silicon nitride composite ceramics with excellent mechanical properties were prepared by hot pressing. The effects of temperature on the sintering process,  $\beta$ -Si<sub>3</sub>N<sub>4</sub> phase transformation ratio ( $\beta$ %) and mechanical properties were investigated. By calculating the diffraction intensity (I), the  $\beta$ -Si<sub>3</sub>N<sub>4</sub> phase transformation ratios of the three samples considered in this study were 57.2% (pre-sintered samples, PSN), 63.5% (urea homogeneous precipitation method, USN) and 66.6% (mechanical milling method, MSN) at 1550 °C, respectively. These results showed that the Si<sub>3</sub>N<sub>4</sub> composites coated by using Y-Al precursor (USN) have a lower ratio of the phase transformation from  $\alpha$  to  $\beta$ . Meanwhile, from the analysis of SEM images of the etched surface, the grain sizes were 0.47  $\mu$ m (PSN), 0.39  $\mu$ m (USN), and 0.43  $\mu$ m (MSN) at 1650 °C, respectively. Compared to the other samples, the USN sample offered superior sintering behaviour and mechanical properties. The optimal flexural strength, hardness and fracture toughness of the Si<sub>3</sub>N<sub>4</sub> composites coated by using the Y-Al precursor were 911±69 MPa, 16.23±0.24 GPa and 4.9±0.35 MPa/m<sup>2</sup> at 1650 °C, respectively.

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