

High-Temperature Tribological Characterization of Nano-Sized Silicon Nitride + 5% Boron Nitride Ceramic Composite

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Abstract : Tribological studies on nano-sized β -silicon nitride+5% BN were carried out in dry air at high temperatures to clarify the lack of consensus in the bibliographic data concerning the Tribological behavior of Si₃N₄ ceramics and effect of doped hexagonal boron nitride on coefficient of friction and wear coefficient at different loads and elevated temperatures. The composites were prepared via high energy mechanical milling and subsequent spark plasma sintering using Y₂O₃ and Al₂O₃ as sintering additives. After sintering, the average crystalline size of Si₃N₄ was observed to be 50 nm. Tribological tests were performed with temperature and Friction coefficients 0.16 to 1.183 and 0.54 to 0.71 were observed for Nano-sized β -silicon nitride+5% BN composite under normal load of 10N-70 N and over high temperature range of 350 °C-550 °C respectively. Specific wear coefficients from 1.33×10^{-4} mm³N⁻¹m⁻¹ to 4.42×10^{-4} mm³N⁻¹m⁻¹ were observed for Nano-sized Si₃N₄ + 5% BN composite against Si₃N₄ ball as tribo-pair counterpart over high temperature range of 350 °C-550 °C while as under normal load of 10N to 70N Specific wear coefficients of 6.91×10^{-4} mm³N⁻¹m⁻¹ to 1.70×10^{-4} were observed. The addition of BN to the Si₃N₄ composite resulted in a slight reduction of the friction coefficient and lower values of wear coefficient.

Keywords : ceramics, tribology, friction and wear, solid lubrication

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