

Silicon Nitride Ceramics - Fascinating Properties

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Abstract:

Silicon nitride is one of the most widely used engineering ceramics for a variety of structural applications because of their excellent mechanical properties. During the last four decades, a great deal of research effort has been devoted for tailoring the microstructures and enhancing the properties, leading to remarkable progress of this material. Particularly, in recent years, a lot of attention has been collected to studies on small or thin parts of silicon nitride because of their expanding application field. This paper gives an overview on such progress of silicon nitride ceramics, focusing on the processing-structure-properties relationship. Some examples will be shown on how a unique processing route generates a novel microstructure, which brings enhanced properties in turn. As one of the most representative applications nowadays, the paper addresses high thermal conductivity silicon nitride substrates for next-generation power devices and their latest achievements. Emphasis is also placed on mechanical properties of microstructural elements including grains themselves, which play important roles in determining performance of such micro-devices.