

Powder-Free Processing of Advanced Ceramics with Multifunctional Properties

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There is presently much effort in basic science and applied research to work on novel materials with properties far beyond that of the existing ones. Aim and scope of the research in this field is to develop materials with superior thermomechanical, physical and chemical properties. In particular, the synthesis of carbonitride and oxycarbide based ceramic devices from molecular inorganic polymers has attracted increasing attention for the production of dense and porous ceramic composites, fibers or coatings. One important advantage of polymer derived ceramics is their potentially simple processing to complex components by extrusion or injection molding of polymer masses or by cold machining of compacted polymer parts. These processing routes avoid the use of ceramic starting powders and can be considered as a powder-free technology. Moreover, novel ceramic compositions such as ternary, quaternary and quinary silicon based carbonitrides and oxycarbides can be synthesized by the polymer-to-ceramic transformation route. While silicon containing carbonitrides have been found to be extremely high temperature resistant with respect to crystallization, decomposition, creep, and oxidation, silicon based oxycarbides reveal a similar property profile with lower values but at a significant lower cost level. In this presentation, the progress in synthesis and processing of molecular preceramic compounds as well as some properties of advanced ceramics and ceramic nanocomposites derived therefrom are reviewed.

Literature:

P. Colombo, G. Mera, R. Riedel, G.D. Soraru, J. Am. Ceram. Soc. (2010) DOI: 10.1111/j.1551-2916.2010.03876.x