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Reticulated porous silicon nitride-based ceramics

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The interest towards the production of porous silicon nitride originates from the unique combination of light weight, of mechanical and physical properties typical of this class of ceramics that make them attractive for many engineering applications. Although pores are generally believed to deteriorate the mechanical properties of ceramics (the strength of porous ceramics decreases exponentially with an increase of porosity), the recent literature reports that porous silicon nitride can exhibit outstanding mechanical properties even at certain porosity levels, such as heat resistance and chemical resistance, damage tolerance, the thermal shock resistance and the strain tolerance.

A study on silicon nitride characterized by high porosity content (more than 70%) has been carried out, focusing on the comparison of different processing procedures to produce silicon nitride with tailored novel porous structures and a high porosity content. Three technologies were compared to produce reticulated porous silicon nitride:

- 1) impregnation of templating structures (sponges) with ceramic powder slurries. Production of highly porous ceramic bodies using pyrolizable porous templates is quite a common process for almost any kind of ceramic material. Open porosities over 50% vol. can be easily achieved by using solid foamed sponges, both in polymeric materials and cellulose.
- 2) using a consolidator/binder and a pore former,
- 3) from foamed suspensions stabilized through organic additives.

Some mechanical properties are reported and discussed in terms of microstructure and fabrication techniques.