

Engineering of microstructures of ceramic oxides using Flash or High-Pressure Spark Plasma Sintering

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In the field of materials processing, particularly in powder metallurgy, non-conventional sintering techniques such as Spark Plasma Sintering (SPS) have demonstrated strong potential for addressing key challenges in the development of functional ceramics with optimized microstructures and tailored properties. Technical ceramics play a critical role in a wide range of sectors, including energy, biomedical, and transportation industries such as automotive, aerospace, and space applications. Among these materials, yttria-stabilized zirconia (YSZ) is especially attractive due to its combination of outstanding properties, including high mechanical strength and electrical conductivity. However, YSZ is typically densified at temperatures of 1100 °C or higher, which results in grain sizes exceeding 0.3 µm. Achieving dense nanostructured YSZ (relative density > 95%, grain size < 200 nm, and pore size < 50 nm), even by conventional SPS, remains an unresolved challenge.

In this presentation, we demonstrate how advanced SPS variants—namely rapid sintering via Flash-SPS (F-SPS) and low-temperature sintering via High-Pressure-SPS (HP-SPS) applied to commercial nanopowders enable optimization of the microstructure and properties of YSZ nanoceramics. The mechanical properties of the resulting materials are discussed in relation to their structure and microstructure, and are compared with those obtained using conventional sintering and classical SPS routes.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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