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Heating rate impact on sintering and microstructural evolution of YSZ nanopowder

Rapid heating is a cornerstone of modern sintering approaches like flash sintering, ultrafast high temperature sintering (UHS), fast firing, microwave sintering, or spark plasma sintering. Besides the technological interest, fundamental answers are emerging about how the heating rate can tailor the ceramic structure from the micro- to the nano-scale.
Herein, we study the rapid consolidation of YSZ nanopowder by UHS, showing an impressive acceleration of the densification mechanisms induced by the fast heating process. Starting from those results, we tried to identify whether heating rate can impact the consolidation also in "conventional"conditions, i.e., under 2.5 −50℃/min. It is shown that the particle size and the state of the green body play a crucial role. Also, the broadness of the particle size distribution has an impact on the heating rate-sensitivity of the densification process.
It is observed that tiny nanopowders, especially if strongly agglomerated, are extremely sensitive to the heating rate effects. In extreme cases, the work of sintering at a fixed density level can vary by 3 orders of magnitude, increasing the heating rate from 2.5 to 50℃/min. This is primarily ascribed to a deviation in the microstructure -density relations induced by surface-mediated phenomena.

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Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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