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Ultrafast High-Temperature Sintering (UHS)

Ceramic materials screening rates are limited by the long processing time of conventional ceramic synthesis and sintering techniques, which are also prone to poor compositional control due to volatile element loss. To overcome these limitations in ceramic synthesis and processing, we report an ultrafast high-temperature sintering (UHS) process for the fabrication of ceramic materials by radiative heating that features a record-high temperature of up to 3,000 ℃ and an ultrafast heating rate of up to 100,000 ℃/minute. The UHS method can directly sinter oxide precursors into solid, dense ceramics in seconds. Compared with previous fabrication techniques, the UHS process is >100–1000-times faster. As a result, we are able to achieve excellent compositional control of ceramics containing volatile components, as well as prevent uncontrolled grain growth for outstanding material performance. Furthermore, this technique is compatible with 3D printing to produce novel ceramic structures and devices that are otherwise impossible to achieve by other rapid sintering methods. Finally, the UHS process is universal, allowing us to synthesize a wide range of new metal and ceramic materials with novel composition and structure. This technique has the potential to transform and expand the discovery of ceramic compounds, with significant impacts for rapid materials screening and solid-state batteries.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

Yes

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