

# Impact of sintering techniques on the densification and transparency of high-entropy garnet ceramics

High-entropy ceramics with a garnet structure have recently emerged as a promising class of materials due to their exceptional thermal stability, chemical robustness, and the tunability of their properties through multication substitution. These materials offer broad potential for advanced functional ceramics with tailored mechanical, optical, and electronic properties. In this work, a transparent high-entropy garnet,  $(\text{Er}_{0.01}\text{Lu}_{0.2}\text{Yb}_{0.2}\text{Y}_{0.34}\text{Gd}_{0.2}\text{La}_{0.05})_3(\text{Al}_{0.5}\text{Sc}_{0.5})_2$  was prepared and sintered, overcoming the challenges of full densification in complex multicomponent systems. To achieve optical transparency, appropriate sintering additives were employed. To minimise unwanted interactions between individual oxides during solid-state sintering, precursor powders were synthesised via combustion synthesis, producing fine, compositionally homogeneous particles with a stable garnet structure. Consolidation was carried out using two techniques: spark plasma sintering and vacuum sintering, each with distinct sintering additives. The effects of the densification method and additive type on densification behaviour, microstructural evolution, and material performance, with particular emphasis on photoluminescence, were systematically evaluated. This study provides insights into the relationships between synthesis route, sintering strategy, microstructure development, and optical functionality in high-entropy garnet ceramics.

## Professional Status of the Speaker

Senior Scientist

## Interest in submitting a paper in a special issue of

Journal of the European Ceramic Society (Elsevier)

## Invitation letter for visa

No

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**Session Classification:** Sintering of specific material systems

**Track Classification:** Group 4: Sintering of specific material systems