

Sintering aids for transparent high-entropy garnet ceramics

High-entropy ceramics are promising materials for advanced optical applications, particularly for their enhanced thermal stability and tunable spectral properties. However, achieving full density and eventually optical transparency remains challenging in multicomponent systems, as sluggish diffusion kinetics can hinder pore elimination. Furthermore, chemical complexity increases the risk of elemental segregation or secondary phase formation due to unwanted reaction with the sintering aid.

The present study focuses on optimising the sintering strategy for a garnet with the composition $RE_3Al_3Sc_1Ga_1O_{12}:Er^{3+}$ (RE = Lu, Yb, Y, Gd, La). The objective was to identify suitable sintering aids and a sintering regime for obtaining transparent ceramics. The high-entropy compound was synthesised via solution combustion and calcined at 1400 °C to produce a single-phase submicron powder without hard aggregates. Powders were dispersed with various sintering aids (SiO₂, SiO₂+MgO, borosilicate glass) at different concentrations, homogenised, and spray-dried. Following uniaxial and cold isostatic pressing, pellets were vacuum-sintered at various temperatures and dwell times.

Density was measured using Archimedes' method, and SEM-EDX was used to characterise microstructure and chemical homogeneity. Optical transparency was quantified through RIT measurements. The influence of sintering aid type, concentration, and vacuum sintering parameters on densification and transparency was evaluated.

Professional Status of the Speaker

Doctoral or Master Student

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