Contribution ID: **47** Type: **POSTER**

Fabrication and Characterization of Lanthanide-Doped Oxide Materials for Sensing Applications

Oxides doped with rare-earth elements (REEs) have garnered significant attention for their strong photoluminescent properties in sensing applications. REEs are used in many high-performance technologies due to their unique 4f electronic transitions. Although the oxides are not inherently luminescent, they serve as excellent host for lanthanide-ion doping because of their open structure, thermal stability, oxygen mobility, and tunability enabled by partial or complete substitution at the A- or B-site cations. These nanoscale scintillators can be used in a variety of sensing applications, including light-emitting diodes, nuclear radiation detection, and medical imaging. The main objectives of this study are to synthesize, characterize, and enhance the luminescence of lanthanide-ion-doped materials. A simple calcination method was used to synthesize a series of oxide materials. Powder X-ray diffraction (PXRD) confirmed that all synthesized pure-phase materials. Scanning electron microscopy (SEM) was used to obtain high-magnification images of the materials, which revealed a mixture of plate-like and spherical particles. Spectrophotometry and electron probe microanalysis (EPMA) were used to observe and quantify the photo- and cathodoluminescence of the lanthanide-doped materials, respectively. Energy-dispersive spectroscopy (EDS) was used to verify the nominal elemental compositions. Overall, this research supports the design of lanthanide-ion-doped oxide materials for sensing applications.

Academic or Professional Status

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Session Classification: Poster Session

Track Classification: Materials & Devices: Materials & Devices - (a)