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MATERIALS GENOME INITIATIVE SEMINAR SERIES

Elucidating the Role of Boron in Extending Persistence in Eu^{2+} and Dy^{3+} co-doped $Sr_4Al_{14}O_{25}$ by Cathodoluminescence, STEM-EDXS, and Electron Diffraction

Cleva W. Ow-Yang
Sabanci University, Turkey

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CHiMaD Headquarters, Hogan 1160 (1st Floor)

ABSTRACT Strontium aluminate ceramic powders co-doped with Eu and Dy (SAED) luminesce with high intensity and remarkably long afterglow persistence. Such a capability for energy storage and delayed emission of light offers enormous potential for energy efficient lighting and safety signage applications. It has been well known over the last 15 years that B dramatically extends the persistent afterglow from minutes to longer than 14 hours, attributed to thermally stimulated de-excitation of Eu electrons from $4f^6 5d^1$ to $4f^7$ states. Despite substantial efforts computationally and experimentally, which have involved materials synthesis and structural-optical characterization to extract global information, there is still a lack of consensus on the actual mechanism of the extended persistence. To elucidate the mechanism(s) by which B extends the afterglow persistence, we investigated the cathodoluminescence (CL) behavior in 1 mol% Eu^{2+} and 1 mol% Dy^{3+} co-doped $Sr_4Al_{14}O_{25}$ (S4A7) without B and doped with 4.5 mol% B, using the nano-scale resolution capabilities of a dedicated scanning transmission electron microscope (STEM). We also analyzed the phase of these samples by electron diffraction analysis and their chemistry by STEM-EDXS. In this talk, I will present our results comparing the CL spectrum images and the STEM-EDX spectrum images. Boron strongly influences the microstructural evolution by promoting the growth of large crystals of the long persistence S4A7 phase and is also associated with homogenizing the distribution of Eu^{2+} in the S4A7 structure.

Cleva Ow-Yang *obtained her Ph.D from Brown University and then worked as a Chateaubriand Science & Technology fellow at Thales, Orsay and later as a Humbolt Fellow at Max Planck Institute, Stuttgart. She is now an Associate professor at Sabanci University, Turkey and also was a visiting professor at MIT. Her research is focused on the theme of Manipulation and Management of Light Through Materials Engineering. She was also the organizer of a workshop on Thermodynamics of Interfaces in 2012 and the NanoLegos workshop, an international workshop on construction with nanoscale building blocks in 2011, both at Sabanci University, Turkey.*