



Contribution ID: 255

Type: Invited talk

Probing Dopant and Defect Energy Levels in Next Generation Nitride Phosphors

Friday 30 August 2024 14:40 (20 minutes)

My talk will focus on nitride semiconductors used for lighting applications. I will give an overview of our group's soft X-ray spectroscopy at the endstation for inelastic soft X-ray scattering at the REIXS beamline at CLS. We use X-ray absorption (XAS), X-ray emission (XES), Resonant inelastic X-ray scattering (RIXS) and X-ray excited optical luminescence (XEOL) to probe the electronic structure of new nitride semiconductors used in lighting applications. Our density functional theory calculations model the measured spectra and allow to extract more detailed information from the systems studied.

The examples I will discuss include Eu-doped nitrides where we are able to experimentally directly determine the energetic separation of the Eu 5d state and the conduction band of the host lattice. The 5d energies are critical to the color and efficiency of LED phosphors.

We also directly observe conduction to valence band and 4f to valence band transitions in X-ray excited optical luminescence spectra of a series of cutting-edge phosphors [1-3].

In a series of new nitride semiconductors, intraband states caused by defects are monitored by luminescence and the measurements are compared to our density functional theory calculations.

Finally, I will present a new nitride, GeP_2N_4 , which is structurally distinct from all other known MP_2N_4 systems ($M = \text{Be, Ca, Sr, Ba, Mn, Cd}$) due to the presence of unique Ge^{2+} lone pairs [4-5].

References

- [1] Z. Yang et al., *Advanced Materials* 35, 2301837 (2023)
- [2] T.M. Tolhurst et al., *Chem. Mat.* 29, 7976-7983 (2017)
- [3] M.R. Amin et al., *Adv. Opt. Mat.* 8, 2000504 (2020)
- [4] T. de Boer et al., *J. Mat. Chem. A* 11, 6198-6204 (2023)
- [5] S.J. Ambach et al., *Angewandte Chemie (Int. Ed.)* 135, e202215393 (1 to 5) (2023)

I plan to submit also conference proceedings

No

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