

Inorganic phosphors for optical applications

Keywords: phosphor, spectroscopy, lanthanides, wLEDs, bioimaging



National Institute for Materials Science

Background

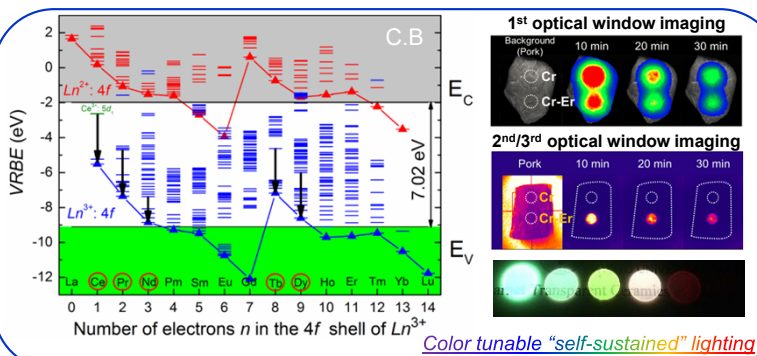
Inorganic phosphors, have experienced over 400 years long-standing history starting from the famous “Bologna stone”, and found important access with solid-state lighting, bioimaging, etc., just at the flip of a switch. Nowadays, more specific and improved luminescent properties, e.g., emitting wavelength, QE, lifetime are highly demanded which motive the development of new phosphors for emerging optical applications.

Aim

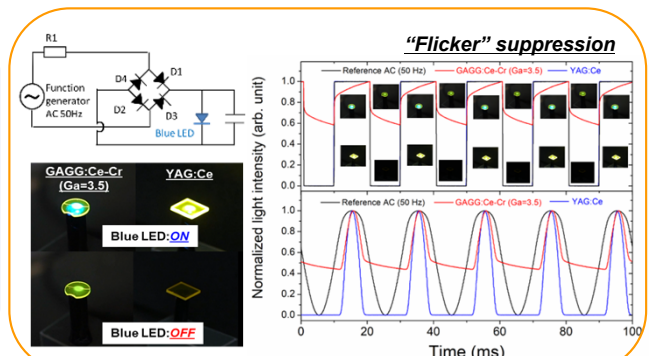
- Development of new NIR persistent phosphors for bioimaging based on energy level and band structure modeling of lanthanide/transition-metal activators and hosts.
- Detailed characterization of new phosphors toward NIR AC-LED, ratiometric thermo-sensing, and phosphor-converted LED/LD driven solid-state lighting.

Advanced Research Topics

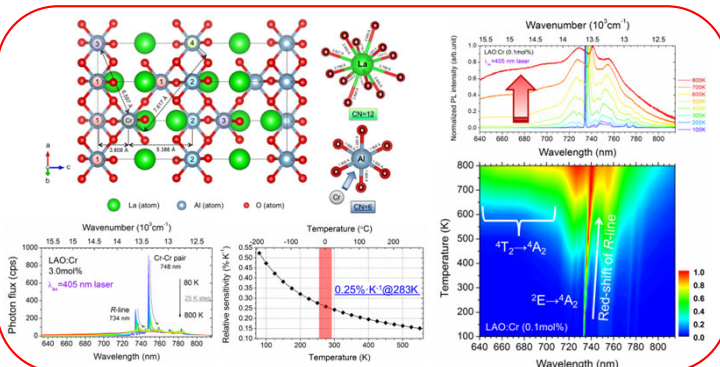
Energy level & band structure modeling



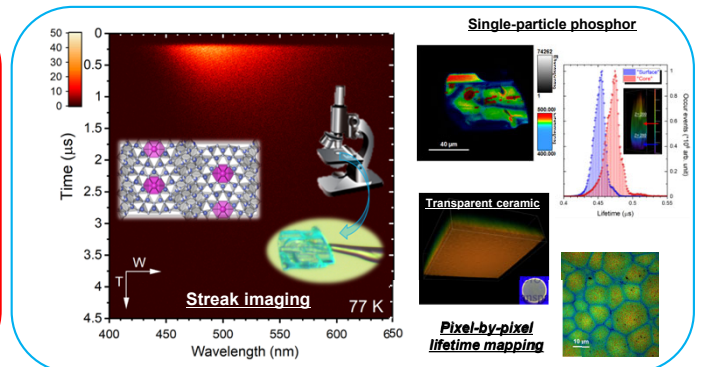
Alternating current (AC)-driven LEDs



Narrow-band ratiometric thermometer



Single-particle-diagnosis + time-resolved spectroscopy



Publications

- J. Xu *et al.*, *J. Lumin.*, **205** (2019) 581.
J. Xu *et al.*, *ECS J Solid State Sci Technol.*, **10** (2021) 116002.
J. Xu *et al.*, *Phosphor Handbook (3rd edition)*, CRC Press (2022) 363.

Summary

- New phosphors are developed for AC-LEDs, temperature sensing, and biomedical imaging.
- Extended toolboxes of single-particle-diagnosis approach are established by time-resolved spectroscopy with streak/confocal imaging.

Research outcome

- New insights into luminescent mechanism and manipulating energy levels of doping activators of inorganic phosphors toward emerging optical applications such as NIR-II/III bioimaging, AC-LEDs, high-power laser lighting, etc.



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