

Seminar über Ultrafast Science and Technology

Referent: Dr. Lucas Erasmus, University of the Free State, South Africa

Titel: The State of the Art of Phosphor Technologies

Phosphor materials exhibit luminescence when stimulated by ultraviolet light, X-rays, or electron beams. This luminescent behaviour results from the excitation of the material's activator ions, often rare-earth elements or transition metals, within a host lattice. As the excited electrons return to a lower energy state, they emit photons, with the wavelength of the emitted light mainly being determined by the type of activator ions present.

Historically, these materials were critical to developing technologies like fluorescent lighting and cathode-ray tube (CRT) displays. Today, phosphors are used in energy-efficient white light-emitting diodes (LEDs) and display technologies. The shift to these modern applications has required continual refinement of phosphor materials to meet the demands of improved colour rendering, efficiency, and longevity [1]. In addition to consumer electronics, phosphors play a vital role in scientific and medical settings, particularly in temperature sensing. [2], scintillations for radiation detection, and emerging technologies like high-efficiency solar cells and latent fingerprint detection [3].

This talk will review the current state of phosphor materials research, focusing on their role in various technologies and the material properties required for each application.

[1] P. F. Smet, A. B. Parmentier, and D. Poelman, "Selecting Conversion Phosphors for White Light-Emitting Diodes," *J Electrochem Soc*, vol. 158, no. 6, p. R37, 2011, doi: 10.1149/1.3568524.

[2] S. N. Ogugua, L. J. B. Erasmus, and H. C. Swart, "Ca₄(PO₄)₂O:Eu²⁺, Eu³⁺ phosphor enabled sundry spectral range sub-K optical thermometry," *Mater Res Bull*, vol. 164, p. 112256, 2023, doi: <https://doi.org/10.1016/j.materresbull.2023.112256>.

[3] R. Singh et al., "Harvesting Sub-bandgap Photons via Upconversion for Perovskite Solar Cells," *ACS Appl Mater Interfaces*, vol. 13, no. 46, pp. 54874–54883, Nov. 2021, doi: 10.1021/acsami.1c13477.

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