Pr^{3+} Activated Inorganic Phosphors – Synthesis, Characterisation, and Applications

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Introduction

Inorganic phosphors are luminescent pigments which are used in many technical applications, e.g. lighting, imaging, and detection. Compounds which contain trivalent praseodymium are a well-studied group of luminescent materials. This presentation will deliver a brief overview.

Synthesis and Characterisation

Phosphors are produced via various syntheses routes to obtain nano- or micro-scale materials e.g.,

- **solid-state**
- **precipitation**
- **hydrothermal**
- **combustion**
- **sol-gel**

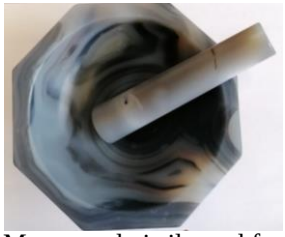


Fig. 1: Mortar and pistil, used for the homogenisation of reaction mixtures

In order to thoroughly characterise a phosphor and assess its quality, various spectroscopic methods are required e.g.:

- **Reflection spectroscopy**
- **Excitation spectroscopy**
- **Emission spectroscopy**
- **X-ray excited luminescence measurements**
- **Time dependent spectroscopy**
- **Temperature dependent spectroscopy**

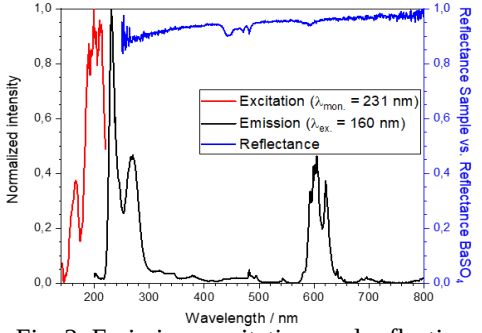
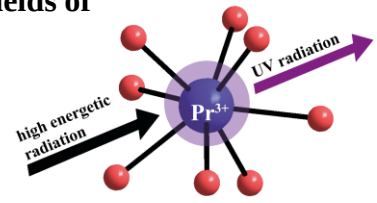


Fig. 2: Emission, excitation, and reflection spectra of $Sr_3(PO_4)_2:Pr^{3+},Si^{4+}$

Applications

Pr^{3+} containing phosphors are used in or discussed for the use in different fields of application e.g.:

- **As scintillators**
- **As colour filter for glasses**
- **For disinfection purposes**
- **For biomedical applications**
- **For cancer therapy**
- **As laser gain media**



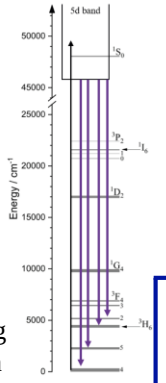


Fig. 3: Schematic representation of the electronic transitions in a Pr^{3+} containing phosphor during excitation and emission

Examples for Pr^{3+} containing phosphors:

- **$YPO_4:Pr^{3+}$, $LaPO_4:Pr^{3+}$, $LuPO_4:Pr^{3+}$**
- **$Lu_3Al_5O_{12}:Pr^{3+}$, $Y_3Al_5O_{12}:Pr^{3+}$**
- **$KY_3F_{10}:Pr^{3+}$, $LiYF_4:Pr^{3+}$**
- **$YBO_3:Pr^{3+}$, $LaBO_3:Pr^{3+}$, $LuBO_3:Pr^{3+}$**
- **$Sr_3(PO_4)_2:Pr^{3+},Si^{4+}$**
- **$Sr_3(BO_3)_2:Pr^{3+},Na^+$**

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TOM Tailored Optical Materials
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