

# Energy level modeling of lanthanide defects in SrGa<sub>2</sub>S<sub>4</sub>

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Most lanthanide ions show an interesting variety of luminescent features when doped in inorganic crystals. Depending on the electronic structure of ground and excited states, one can observe broadband emission due to interconfigurational  $4f^N \rightarrow 4f^{N-1}5d^1$  transitions or line emission due to intraconfigurational  $4f^N \rightarrow 4f^N$  transitions. Furthermore, coupling with the host crystal gives rise to charge transfer transitions.

Stontium thiogallate (SrGa<sub>2</sub>S<sub>4</sub>) is a well-known phosphor host material. Doped with divalent europium (Eu<sup>2+</sup>), a high efficiency phosphor with a saturated green emission is obtained, useful for LED applications [1]. This material is extremely suited for the use in displays where saturated colors are essential for obtaining a large color gamut [2, 3]. In this work, it is investigated whether other lanthanide dopants activate a similar efficient luminescence when incorporated in SrGa<sub>2</sub>S<sub>4</sub>. It is shown how spectroscopic techniques can be addressed to construct an energy level scheme for all divalent and trivalent lanthanides with respect to the host material and the vacuum. The constructed energy level scheme is of importance for explaining the origin of the different observed phenomena.

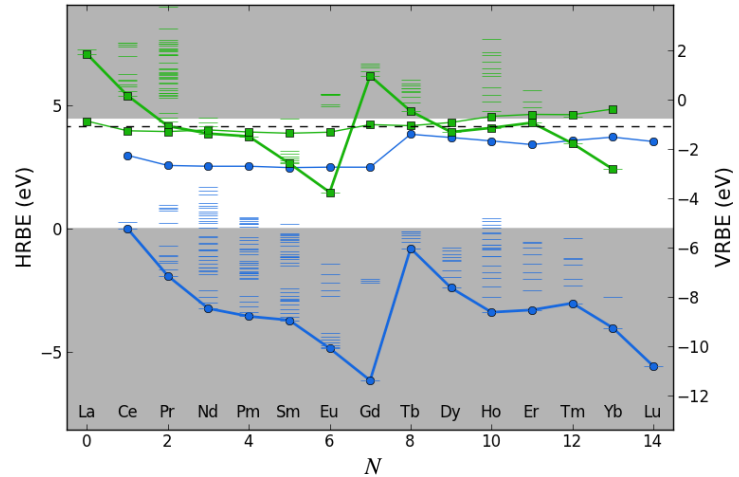


Fig. 1. Energy level scheme of SrGa<sub>2</sub>S<sub>4</sub>:Ln

- [1] J. J. Joos, K. W. Meert, A. B. Parmentier, D. Poelman, P. F. Smet, *Optical Materials* **34** 11, 1902-1907 (2012).
- [2] P. F. Smet, A. B. Parmentier, D. Poelman, *J. Electrochem. Soc.* **158**, R37-54 (2011).
- [3] R. J. Xie, N. Hirosaki, T. Takeda, *Appl. Phys. Express* **2**, 022401 (2009).
- [4] P. Dorenbos, *Journal of Solid State Sciences and Technology*, R3001-R3011 (2013)