

Systematics in the luminescence of ns^2 ions

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Luminescent materials or phosphors play an important role in many everyday applications such as lighting and displays. These phosphors consist of a host compound doped with luminescent ions called activators. Almost all the commercial phosphors used today are activated by lanthanide ions[1]. However, a few years ago the rare-earth market was struck by a crisis when China, the leading exporter of rare-earth oxides, imposed export quotas. This led to a renewed interest into possible alternatives for the lanthanide-based phosphors. The purpose of this work is to investigate some of these possible alternatives: ions featuring an ns^2 electronic ground state such as Pb^{2+} , Sn^{2+} , Bi^{3+} and Sb^{3+} .

Phosphors which are used for different applications have to meet different requirements [2]: while conversion phosphors used in fluorescent lamps are excited by ultraviolet line emission, those used in light-emitting diodes (LEDs) are often excited by near ultraviolet or blue band emission. It can readily be seen that, in the absence of a model, designing a new phosphor that satisfies all these requirements would be very time consuming and would essentially come down to a trial and error process of combining several hosts with different activators.

While a systematic investigation of the luminescence of lanthanides in different hosts has already been carried out, this is still lacking for the ns^2 ions [3,4]. Therefore, after a short introduction about the optical properties of these ions, a model describing the systematics of their luminescence will be presented. This model is based on data collected from the available archival literature and its validity is tested by applying it to a case study where these dopants are embedded in CaS and SrS.

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[4] J. J. Joos, D. Poelman, P. F. Smet, *Phys. Chem. Chem. Phys.* 2015, **17**, 19058-19078.