Concentration distribution of Pb^{2+} ions in PbF_2:BaF_2 crystals

Gabriel Buse[1]*, Marius Stef[2], Irina Nicoara[2], Madalin Bunoiu[2], Maria Poienar[1], Philippe Veber[3].
*lead presenter: gabriel.buse@e-uvt.ro
1 Institute for Advanced Environmental Research, West University of Timisoara, Romania
2 Faculty of Physics, West University of Timisoara, Romania
3 French National Centre for Scientific Research, Institute of Light and Matter, University Claude Bernard Lyon 1, UMR 5306 Villeurbanne, France

The optical properties of ns^2 ions in crystals is a well-studied research domain [1] and is still receiving a lot of interest among the scientific community. However, there are few reports on optical properties of these ions in alkaline-earth fluorides and among the ns^2 ions, the Pb^{2+} ions are less investigated [2,3]. Fluoride crystals doped with Pb^{2+} ions are materials with great potential in the field of lasers due to their very high intensity emission bands in the near UV spectral region [4]. More recently, the effect of gamma irradiation on the PbF_2 doped BaF_2 crystals was reported [5]. The homogeneous dopant distribution in the laser materials is important because this affects the efficiency of the physical properties.

The aim of this paper is to investigate the influence of PbF_2 content on optical properties of the BaF_2 crystals and to determine the effective segregation coefficient using the optical absorption method.

Bulk barium fluoride crystals doped with various concentrations of PbF_2 have been grown using the Bridgman technique. The optical absorption spectra reveal the characteristic UV absorption bands of the Pb^{2+} ions. The distribution of the Pb^{2+} ions along the crystals has been investigated using the optical absorption method. Taking into account the relationship between the optical absorption coefficient and the concentration of the impurities in the samples, the effective segregation coefficient of the Pb^{2+} ions has been calculated. Luminescence properties in the UV-VIS range (300-330nm) were also investigated under excitation at 290 nm. These bands are attributed to the $^3P_1 \rightarrow {}^1S_0$ transition of Pb^{2+} ion.

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