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Crystal growth of pure and Sn-doped SrI_2 by atmosphere-controlled micro-pulling-down method and its luminescence and scintillation properties

Institute for Materials Research, Tohoku University [1], Institute of Physics AS CR, Czech Republic [2], NICHe, Tohoku University [3], ○Robert Král[1,2], Karel Nitsch[2], Jan Pejchal[1,3], Vladimir Babin[2], Shunsuke Kurosawa[1], Yuui Yokota[3], Martin Nikl[2], Akira Yoshikawa[1]

E-mail: kralr@imr.tohoku.ac.jp

Recently, there has been growing interest in the search for new scintillation materials with fast and efficient response to X-ray and γ-ray radiation and emitting in visible or UV light. Rapidly developing medical imaging techniques, homeland security monitoring, and other fields require materials with extremely high energy resolution. These requirements can be fulfilled by strontium iodide (SrI_2) doped with Eu^{2+} which has high light yield of 83,000 MeV and excellent energy resolution below 3% at 662 keV. However, the contemporary material concept is based on heavy doping (5%) of SrI_2 by one of the most expensive and most critical RE elements, namely Eu^{2+} ion. Moreover, small Stokes shift resulting in reabsorption of Eu^{2+} emission is a serious problem in larger size scintillation elements and degrades both timing and energy resolution characteristics. Thus, search for new doping elements in SrI_2 such as the s^2-ion group (e.g. Sn^{2+}) with suitable luminescence properties is required.

Strontium iodide is a congruently melting compound with melting point at 515 °C and orthorhombic crystallographic structure. But its high hygroscopicity and affinity to atmospheric moisture lead to formation of hydroxoiodides and make preparation of high purity and quality SrI_2 single crystals difficult. These oxidic impurities must be removed from SrI_2 starting material before its crystal growth.

This work deals with preparation of SrI_2 starting material, its doping by Sn^{2+} ion, and crystal growth by the atmosphere-controlled micro-pulling-down (μ-PD) method. Basic optical, luminescence, and scintillation properties of the prepared single crystals will be presented and discussed. Crystal growth, sample processing, and their handling was performed under protective oxygen-free atmosphere throughout all manufacturing process. To the best of our knowledge, preparation and crystal growth of Sn-doped SrI_2 single crystals by the μ-PD method has not been published so far.

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