Luminescence properties of SrI_2 single crystals doped with s^2-group ions grown by modified micro-pulling-down method

Institute for Materials Research, Tohoku University [1], Institute of Physics AS CR, Czech Republic [2], New Industry Creation Hatchery Center, Tohoku University [3], ◦Robert Král[1,2], Karel Nitsch[2], Jan Pejchal[2,3], Vítězslav Jarý[2], Shunsuke Kurosawa[1], Yuui Yokota[3], Martin Nikl[2], Akira Yoshikawa[1,3]

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

Present study of strontium iodide (SrI_2) is motivated by search for new scintillators with fast and efficient response to X-ray and γ-ray radiation with possible applications in new medical imaging techniques, homeland security monitoring, and other fields requiring materials with extremely high energy resolution. Strontium iodide high light yield (over 80,000 photons/MeV) and energy resolution below 3% are achieved by heavy doping (over 5%) by one of the most expensive RE element such as Eu^{2+} ion. Furthermore, the small Stokes shift of the Eu^{2+} luminescence leads to reabsorption of emission and thus to degradation of both timing and energy resolution characteristics. Therefore, search for new doping elements such as those from the s^2-ion group (In^+, Sn^{2+}) with suitable luminescence properties to replace Eu^{2+} ion is required.

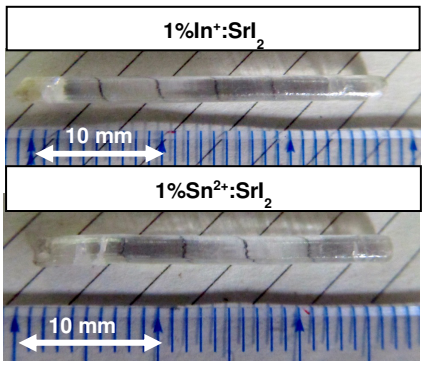

Fig. 1. As grown single crystals of SrI_2 doped with 1 mol% In^+ (top figure) and 1 mol% Sn^{2+} (bottom figure).

Strontium iodide is congruently melting compound (m.p. 538 °C) with no solid-solid phase transition crystallizing in orthorhombic crystallographic structure (space group *Pbca*). Its high hygroscopicity and reactivity with atmospheric moisture results in formation of hydroxoiodides. Removal of these oxidic impurities before its crystal growth is of high importance.

Single crystals of 1%In^+:SrI_2 and 1%Sn^{2+}:SrI_2 were grown under protective high purity argon atmosphere by modified atmosphere-controlled micro-pulling-down method. Prepared crystals were transparent, colorless with no visible cracks or inclusions, see Fig. 1. No segregation or other non-transparent phase during crystal growth was observed. Basic optical and luminescence characterization of prepared single crystals will be presented and discussed.

Acknowledgement

This work was supported by following research projects: (i) by Grant-in-Aid for JSPS Postdoctoral Fellowship for Foreign Researchers (P14040), (ii) Bilateral AS CR-JSPS Joint Research Project supported by MEYS KONTAKT II no. LH14266, (iii) Development of Systems and Technology for Advanced Measurement and Analysis (SENTAN), Japan Science and Technology Agency (JST), and (iv) Adaptable and Seamless Technology Transfer Program through Target-driven R&D (A-STEP), JST.