Optical properties of pure and Sn-doped $\beta$-Ga$_2$O$_3$ single crystals grown by optical Float Zone technique

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Abstract:
Recent research attention has been focused on gallium oxide ($\beta$-Ga$_2$O$_3$) single crystal, which has an ultra-wide bandgap (4.5–5.3 eV) semiconductor. The foremost interest of $\beta$-Ga$_2$O$_3$ crystal emerging from its potential applications in the fields of power devices and photo detectors. There are many reports available in the literature, not only the electrical properties of $\beta$-Ga$_2$O$_3$ but also optical properties. In this study, we extended our investigations on the optical properties of pure and Sn-doped $\beta$-Ga$_2$O$_3$ single crystals. The optically good quality single crystals of pure and Sn-doped $\beta$-Ga$_2$O$_3$ have been grown (shown in Figure 1) by the floating zone technique. X-ray induced luminescence spectrum shows a maximum emission peak at 365 nm. It is well known that $\beta$-Ga$_2$O$_3$ shows defect-related luminescence which is due to recombination between donors (oxygen vacancies) and acceptors (pair of oxygen and gallium vacancies). In addition to this, low-temperature trap center analysis using thermoluminescence glow curves measurements and scintillation characterization under $^{241}$Am $\alpha$-ray excitation will be discussed in more detail.

Figure 1. Photograph of cut and polished Ga$_2$O$_3$ single crystals

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