

Growth and optical properties of large forsterite single crystals doped with manganese

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Forsterite, Mg_2SiO_4 , is one of the important rock-forming minerals in the Earth. Forsterite doped with transition metal ions shows characteristic optical properties. For example, forsterite doped with chromium is used as an active medium of near-IR lasers. There are many studies on chromium doped forsterite, however, there are few studies on those doped with manganese. In order to investigate the optical properties and the crystal structure of manganese doped forsterite, we synthesized large forsterite single crystals using Czochralski-pulling method. We used high purity (99.99%) granular MgO and SiO_2 reagents of 1-3 mm size and pure (99.9%) powder manganese oxides as starting materials. We synthesized two large single crystals with the initial manganese concentrations of 1 and 3 mol %. The two crystals are crack-free and transparent. The crystal sizes are 150-190 mm in length and 50 mm in diameter. The manganese concentrations increase from the top to the bottom of the crystals in the range of 0.3-2.1 and 0.9-3.5 mol %. The Mn concentrations, however, are almost homogeneous perpendicular to the growth direction. We are able to cut homogeneous specimens of 5*5*10 mm size from the as-grown crystals for the optical absorption measurements.

The colors of crystals are pink and relatively pale in comparison with other doped forsterite. They exhibit absorption band around 370 and 410 nm. We will report results of EPMA and X-ray analysis, and also discuss absorption spectra of the doped forsterite.

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