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New mixed LiGa0.5In0.5Se2 nonlinear crystal for the mid-IR

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LiGaSe2 and LiInSe2 are promising nonlinear crystals for conversion of laser radiation to the mid-IR spectral range which are transparent down to the visible and UV. Their band-gaps are 3.57 and 2.86 eV, respectively. This difference results in rather different two-photon absorption coefficients at short pump wavelengths, e.g. 820 nm, where beta<0.07 cm/GW for LiGaSe2 and beta=0.6 cm/GW for LiInSe2. We synthesized a new mixed crystal as solid solution with composition LiGa0.5In0.5Se2 which has the same orthorhombic structure (mm2) as the parent compounds (LiGaSe2 and LiInSe2). The unit cell parameters of LiGa0.5In0.5Se2 are a=7.0376(2) A, b=8.3401(3) A, c=6.6855(2) A, and unit cell volume 392.4 A3. The new crystal is more technological with regard to the growth process in comparison with LiGaSe2 since its homogeneity range is broader in the phase diagram. We established that about 10% of the Li ions are found in octahedral position with coordination number of 3. This feature produces additional distortion in the crystal lattice and may result in enhanced nonlinearity and suppression of photo-induced effects. The band-gap of LiGa0.5In0.5Se2 is estimated to be ~3.2 eV. The dispersion characteristics were measured and Sellmeier equations will be presented. The fundamental wavelength range for the SHG process extends from 1.75 to 11.8 μm. The nonlinear coefficients of LiGa0.5In0.5Se2 are compared with those of LiGaSe2 and LiInSe2.