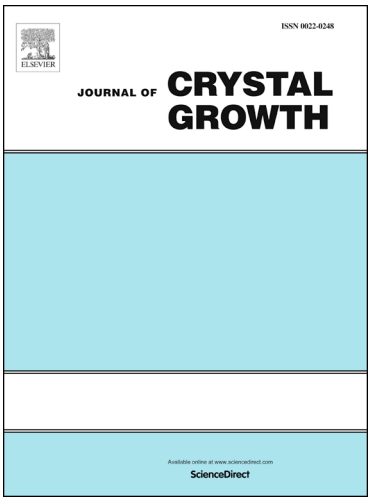

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Structure, phase composition, and some properties of melt grown GaSe:Er crystals

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Abstract

Powder and polycrystals synthesized from Ga, Se, Er components, as well as GaSe and GaSe:Er single crystals grown from melt in argon atmosphere and in vacuum, respectively, are studied. The growth and quenching conditions used in this work provide 2.5 times increase in solubility of erbium in GaSe matrix and a decrease in number of phases to GaSe and Er_2Se_3, oppositely to multiphase GaSe:Er alloys known from literature. For the first time Er_2Se_3 phase was detected by XRD in GaSe crystal doped with 1 at%Er. Possible orientation relations are derived for Er_2Se_3/GaSe epitaxial pair. It has been shown that stretched reflections in electron micro diffraction patterns and scattering of maximums in x-ray diffraction patterns are bound to stacking faults, which appear owing to thin interlayers of δ-GaSe polytype in ε-GaSe matrix of the melt-grown crystals. Morphology of growing crystal surface is studied. Photoluminescence spectra of pure and erbium-doped GaSe display intense photoluminescence bands, which are, presumably, associated with defect states in band gap of GaSe. It is shown that doping with Er has a strong effect on photoluminescence intensity and on its spectral composition. The measured 1.7 times increase in Vickers microhardness (up to 400 MPa) with respect to pure GaSe is due to solid solution hardening and to precipitation.

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