

Unhomogeneously Deformed Structure State of Highly-Doped ZnSe:V Crystals

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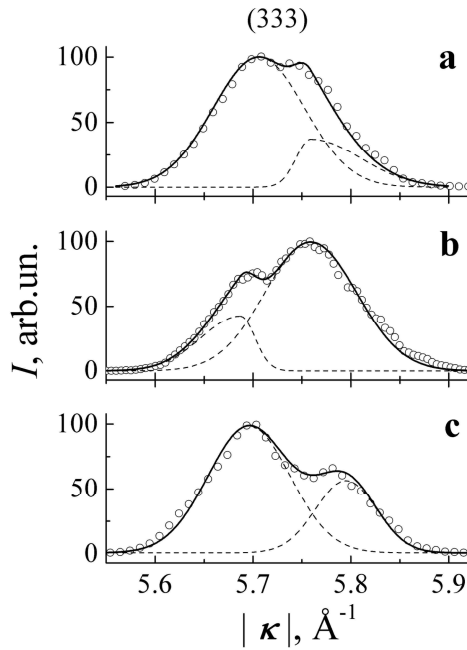


Fig. 1. Neutron diffraction scans of (333) reflections measured along [111] direction of $Zn_{1-x}V_xSe$ single crystals: a) $x=0.01$, b) $x=0.05$, c) $x=0.10$. $T=300K$. \circ – experimental results; dash lines denote fitting of components; solid lines – resulting curves represented by sum of components.

argued for all studied compositions. With appearance of small peaks corresponded by $(1/3\ 1/3\ 1/3)\ 2\pi/a_c$ (a_c – the cubic lattice parameter) knots being in character for II-VI DMSs based on high content of $3d$ -ions [2], some extra observations are presented to shed light on $fcc \leftrightarrow hcp$ pre-transition state detected on investigated ZnSe:V crystals.

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Properties of $A^{II}B^{VI}:V$ alloys belonging to diluted magnetic semiconductors (DMSs) are interesting by their alterations introduced by doped impurity [1]. The presented work is devoted to results of neutronographic structure research carried out on $Zn_{1-x}V_xSe$ single crystals possessing heightened content of foreign Vanadium ions: $x=0.01, 0.05, 0.10$. The crystals were grown by vapor transport. It is checked by neutronographic attestation, the main structure motif of crystal phase of doped crystals should assume sphalerite.

Manifestation of additional “radial” components of neutron scattering depicting the main structure knots (fig.1) of ZnSe:V samples seems to be caused by structure deformed state. Such neutronographic results, in their totality, obtained from the crystals contained high but different content of Vanadium characterize variances of resulting non-uniform deformation field based on local atomic displacements. Rough estimations of “diffraction” deformation characteristics were made by fitting of structure peaks by separation their components along radial directions. Taking into account visible diffuse neutron scattering along tangential directions in the vicinity of strong Braggs, reasons of complicated scattering effects like those demonstrated by fig.1 are discussed. Conclusion about substantial fluctuations from homogeneous volume distribution of foreign Vanadium ions is