Destabilizing factors and forming superstructures in the crystal lattice of highly doped $Zn_{0.9}Ni_{0.1}S$ and $Zn_{0.9}V_{0.1}Se$ cubic crystals

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Materials of II-VI compounds doped by magnetically active 3d- ions and known as diluted magnetic semiconductors (DMSs) are attractive for optoelectronics [1] and, possibly, spintronics applications [2]. In the present work $Zn_{0.9}Ni_{0.1}S$ and $Zn_{0.9}V_{0.1}Se$ single crystals were investigated by neutron diffraction at T=300 K in detail. The obtained neutron diffraction scans show two types of destabilizing consequences, which can coexist in the highly-doped II-VI DMSs samples: namely, the tendencies to long-wave superstructures forming and short-wave structure modulations can be considered as the features of sphalerite lattice destabilizations emerged by interplay between disturbances induced by foreign 3*d*-ions doped and cooperative lattice reaction arising as response on mentioned disturbances. It is clearly seen from the fig 1 that the superstructure characterized by wave vectors q=(1/3 1/3 1/3) $2\pi/a_c$ (a_c – the cubic lattice parameter) is formed in both investigated crystals, but such short-wave modulations can be split by long-wave ones in $Zn_{0.9}V_{0.1}Se$. The evolution of lattice distorted state presented by inhomogeneously deformed nanoregions in which foreign 3d-ions being disturbance centers (proposed earlier and described in [3]) can be considered as possible basis to form fcc-hcp reconstructive phase transition in II-VI matrices when 3d- dopant content is elevated in the direction to its natural solubility limit.

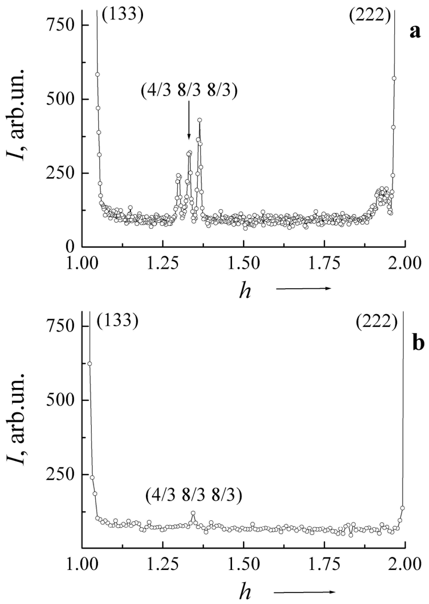

Fig.1. Neutron diffraction scans measured between (133) and (222) knots of (110) plane of reciprocal lattice of $Zn_{0.9}V_{0.1}Se$ (a) and $Zn_{0.9}Ni_{0.1}S$ (b) crystals at 300K.

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