

Physico-chemical nanomaterials science

Ferromagnetic nanosized and dopant-related precipitation in vapor grown CdTe:Cr single crystals

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One of the most challenging tasks of nowadays material science is to obtain the room-temperature ferromagnetic semiconductors for spin-dependent electronics. It was theoretically predicted that CdTe, substitutionally doped with Cr, is a very perspective candidate for this purpose, since superexchange interaction between Cr²⁺ ions in CdTe lattice is ferromagnetic [1].

Investigated CdTe:Cr single crystals were grown by the modified physical vapor transport method using the pre-synthesized charge with 0.5, 2.5 and 5 at.% of Cr content [2]. Nanosized second phase defects, both in the form of near-isometric particles and arranged sets of thin polygons aligned parallel to the {111} planes of the zinc-blende structure, were revealed in the samples with 2.5 and 5 at.% of Cr nominal content by scanning electron microscopy patterning. The results of energy dispersive X-ray and secondary ion mas-spectroscopy analyses and also investigations by means of high-resolution transmission electron microscopy enabled us to identify the planar defects as ferromagnetic chromium telluride intermetallic compounds embedded into the CdTe host matrix. Their appearance was attributed to the dopant precipitation in the course of post-grown cooling process, and the corresponding mechanism of the defect formation was proposed.

Possibility of controlled (driven by the growth conditions) separation of ferromagnetic CrTe-related phase in CdTe crystals in view of their potential functionalities relevant to spintronics was addressed.

1. Blinowski J., Kacman P., Majewski J.A. Ferromagnetism in Cr-based diluted magnetic semiconductors // J. Cryst. Growth. -1996.-**159**, P. 972-975.
2. Popovych V.D., Sagan P., Bester M., Cienek B., Kuzma M. Structural and compositional investigations of vapour grown CdTe:Cr single crystals // J. Cryst. Growth.-2015.-**426**, P. 173-179.