Investigation of defect structure and domains in $Ca_9La(VO_4)_7$ and $Ca_{10}Li(VO_4)_7$ single crystals grown by the Czochralski method

Bedarev A.V[1]., Kosmyna M.B[2]., Mateychenko P.V[2]., Merenkov D.N[1]., Paszkowicz W[3]., Pritula I.M[2]., Poperezhai S[1]., *Shekhovtsov A.N[2].

*shekhov@isc.kharkov.ua

[1] B. Verkin Institute for Low Temperature Physics and Engineering, NAS of Ukraine, Ukraine
[2] Institute for Single Crystals, NAS of Ukraine, Ukraine
[3] Institute of Physics, PAS, Poland

Binary vanadates of "whitlockite" family are widely used for different application: non linear optic converters, laser media, white light transformers. The formation of binary vanadates is caused by heterovalent substitution of calcium. At substitution by rare-earth metals a regular structure contains a vacation. At substitution by alkaline metals vacations aren't formed in a regular structure of compound. Such crystal structures belong to rhombohedral symmetry, R3c space group, and are characterized by phase transition of ferroelectric nature in the "room temperature-melting point" temperature range. For this reason, defect and domain structures were studied for the first time in the $Ca_9La(VO_4)_7$ and $Ca_{10}Li(VO_4)_7$ single crystals grown by the Czochralski method.

Charges for the $Ca_9La(VO_4)_7$ and $Ca_{10}Li(VO_4)_7$ crystal growth were synthesized by solid state reaction according to the chemical reactions, respectively. An automatic puller equipped with a weight control system and inductive heater was used for crystal growth along [001]. Cylindrical crystals of diameter up to 25 mm and length up to 50 mm were grown in an inert atmosphere by the Czochralski technique.

Defect structure of crystal was studied with the use of high-resolution diffraction using a laboratory instrument. Chemical analysis of crystal host elements was performed. Optical polarization method was used for study of domains under different conditions.

It was established that chemical compositions of grown crystals deviate from stoichiometric one, respectively. Both crystals had macromosaic block structure with a value of block misorientation up to 20 arcminutes. Strip like domain structure characterizing by 7-10 μm period was observed.