Adrian Sulich

ABSRTACT OF Phd DISSERTATION

Single-crystal defect structure of selected high-symmetrical, multi-component oxides, containing rare earths

The topic of the dissertation are defects of selected $Ca_9RE(VO_4)_7$, $REVO_4$ and $Ca_3RE_2(BO_3)_4$ monocrystals (where RE = rare earth metal cation) structure, representing crystallographic systems with a high symmetry - rhombohedral, tetragonal or orthorhombic. The above mentioned oxides are promising materials, especially for optoelectronic applications. The previous literature devoted to the oxides concerned mainly the methods of obtaining of these compounds in various crystalline shapes, their using in technology, as well as optical, electrical and magnetic properties, phase transitions, the structure considered at the unit cell level, etc. There are only few publications dealing with lattice defects. But everyone is aware that knowledge of them allows optimization of growth processes in therms of improving the crystal properties of the samples obtained.

The works carried out for the dissertation included: a general crystal quality assessment of the selected materials from $Ca_9RE(VO_4)_7$, $REVO_4$ and $Ca_3RE_2(BO_3)_4$ families, their lattice parameters determination, their phase purity checking, as well as so-called extended defects identification and quantitative description, taking into account their spatial distribution along the monocrystalline samples. The applied research technique was mainly high-resolution X-ray diffractometry using $CuK_{\alpha 1}$ radiation ($\lambda = 1.5406$ Å). The experimental procedures included measurements of diffraction curves (so-called ω and $2\theta/\omega$ scans) and reciprocal lattice points maps for symmetrical and asymmetrical reflections. Additionally, powder X-ray diffraction data and synchrotron topographs of some selected samples were provided. For the interpretation of the data concerning the crystallographic planes bendings in the single crystals, it was proposed a mathematical model for a comprehensive description of the bending profile. There were also proposed other models for micromosaics and lattice parameter spatial distribution analysis.

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A. Sulich