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## Ghost segregation pattern and other defects in mixed strontium-calcium-barium niobates

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We present recent results of the defect structure investigations of selected ferroelectric niobates such as $Sr_xBa_{1-x}Nb_2O_6$ (SBN), $Ca_xBa_{1-x}Nb_2O_6$ (CBN) and mixed $(Ca_{0.28}Ba_{0.72})_y(Sr_{0.61}Ba_{0.39})_{1-y}Nb_2O_6$ (CSBN) single crystals grown by the Czochralski method. The studies were performed by means of synchrotron and conventional diffraction topography and scanning electron microscopy.

The investigations indicated a new very characteristic phenomenon in CSBN crystals, consisting in the presence of two different systems of segregation fringes forming the crossing pattern. First of them is the normal one, connected with the subsequent position of the growth surface and hence is coaxial with the core and the boundaries of the crystal. The second one, crossing the previous, is probably related to the kind of ghost pattern reproducing some chemical composition changes in the new growing part of the crystal. Some rod-like inclusions were also revealed around the core in the central part of samples cut out from various crystals. Contrary to previously studied SBN and CBN crystals, any glide bands in the CSBN were observed.

The scanning electron microscopic studies of selectively chemical etched samples revealed the domain structure in SBN and CBN crystals. The domains (probably ferroelectric domains) were located along [001] directions. They are not directly observed in the diffraction topography, but they probably contribute to the enhanced intensity in some reflections.

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## Local inhomogeneities of strontium titanate thin films doped with iron

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The resistive switching phenomenon attracted a lot of attention in recent years thanks to its possible applications. The ability to change the resistivity of the material by applying external field only seems ideal for a new type of non-volatile memory – the Resistive Random Access Memory. Among many materials exhibiting resistive switching phenomena, the strontium titanate is quite suitable for basic investigations since it can be considered a model material due to its simple structure, good quality single crystals availability and substantial literature on its various properties.

Although it was already shown that the changes of the resistivity switching originates form the local oxygen modification by the external field [1], the work is far from complete. For example doping with transition metals should influence the electrical properties of the material and thus has to be investigated.

Therefore in our work we focus iron doped $SrTiO_3$ in a most suitable for applications thin film form. The thin films obtained by pulsed laser deposition method on Nb doped $SrTiO_3$ substrates were doped with 1, 2 and 5% Fe. Several techniques were used to study the thin film properties, such as: X-ray Photoelectron Spectroscopy and Local Conductivity Atomic Force Microscopy along with the magnetic measurements. Results showed that the electric behavior in nanoscale is very inhomogeneous and well conducting spots of various sizes (from several nm up to 100 nm) are found. Moreover some of the results made us curious about the iron dopant distribution in the matrix, therefore we turned to X-ray photoemission microscopy measurements. We found a small iron inhomogeneities in case of 20 nm thick film and quite interesting structure in the case of 100nm thick film.

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