

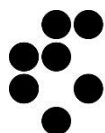


**COST MP 1308 ACTION
TOWARDS OXIDE BASED
ELECTRONICS**

**COST TO-BE FALL
MEETING 2016**

City Hotel Ljubljana, Slovenia,
28–30 September 2016

PROGRAMME AND BOOK OF ABSTRACTS



Institut "Jožef Stefan", Ljubljana, Slovenija



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City Hotel Ljubljana, Slovenia

28 – 30 September 2016

Organized by

COST MP 1308 ACTION

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Microstructure and functional properties of Sr-doped $K_{0.5}Na_{0.5}NbO_3$ thin films

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The legislation against the use of lead-based piezoelectric materials in electronics has stimulated an increased research in the field of the lead-free piezoelectric ceramics and thin films after 2003. Among lead-free materials, special attention was paid to some compositions of potassium sodium niobate solid solution, $K_{0.5}Na_{0.5}NbO_3$ (KNN) obtained by a partial replacement of A- and B- site atoms from the perovskite KNN crystal lattice with dopants. Excellent piezoelectric and ferroelectric properties of chemically modified KNN ceramics indicate that they can be used as the efficient lead-free counterparts to lead-based piezoelectrics.

Although A-site doping of KNN ceramics with low amounts of alkaline earths (Ca^{2+} , Sr^{2+} , Ba^{2+}), particularly with Sr^{2+} was reported as an useful way in improvement of their density and electrical properties [1, 2], there is no literature data concerning the microstructure and functional properties of KNN thin films influenced by the same chemical modification.

In this contribution, liquid precursors of $(K_{0.5}Na_{0.5})_{1-y}Sr_yNbO_3$ (KNN-ySr) thin-films, where the Sr- dopant content was set at $y = 0, 0.005, 0.01$, were prepared from potassium and sodium acetates and niobium ethoxide in 2-methoxyethanol solvent with 5 mole % of potassium acetate excess, and an appropriate amount of strontium acetate dissolved in acetic acid. The approximately 250 nm thick KNN-ySr thin films on Pt/TiO_x/SiO₂/Si substrates were obtained through repeated spin-coating and pyrolysis steps at 300 °C for 2 min, followed by the rapid thermal annealing at 650 °C in air flow for 5 min with a heating rate of 12 K/s.

According to X-ray diffraction analysis, all of the synthesized KNN thin films crystallize in pure perovskite phase with (100) preferential orientation. The surface and cross-section microstructure analysis, performed by the field emission scanning electron microscopy, reveals that the KNN-ySr films consist of equiaxed grains, the average size of which gradually decreases from about 90 nm to a few tens of nm by increasing the Sr-dopant content. Dielectric properties versus frequency, polarisation – electric field dependence and leakage current were followed in order to get information on how the Sr-dopant content influences the functional properties of the as-prepared films. In addition, the topography and the local piezoelectric response of the KNN-ySr films were analysed by atomic force microscopy coupled with a PFM mode.

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