

# Nanocomposites and nanomaterials

## Characterization and dielectric properties of $\text{KTaO}_3$ ceramics co-doped with Li and Co: Size effects

I.S. Golovina<sup>1</sup>, S.V. Lemishko<sup>1</sup>, O.O. Andriiko<sup>2</sup>

<sup>1</sup>*Institute of Semiconductor Physics, National Academy of Sciences of Ukraine, pr. Nauky 41, 03028 Kyiv, Ukraine*

E-mail: [sleeper1986@ukr.net](mailto:sleeper1986@ukr.net)

<sup>2</sup>*National Technical University of Ukraine "KPI", pr. Peremogy 37, 03056 Kyiv, Ukraine*

Potassium tantalate ( $\text{KTaO}_3$ ) is a classic incipient ferroelectric, which is often used as a model structure in the fundamental studies of the physics of ferroelectrics. Also, this material attracts the interest of researchers due to its unique functional properties already exploited in some applications [1].

In the present work, the influence of Li and Co co-doping on the grain sizes, morphology and dielectric properties of  $\text{KTaO}_3$  ceramic samples is investigated. Two fabrication procedures were used for obtaining of the doped  $\text{KTaO}_3$ : a conventional ceramic route via calcination of the mixture of  $\text{Ta}_2\text{O}_5$ ,  $\text{KCO}_3$  and additives, and a recently developed technology based on the oxidation of Ta powder in molten  $\text{KNO}_3$  [2]. XRD analysis showed a pure  $\text{KTaO}_3$  phase without secondary phases for all powders. The decrease of particle sizes upon doping is observed. The average particle sizes are 200 and 80 nm for the doped  $\text{KTaO}_3$  powders, obtained by the conventional ceramic route and by metallic Ta oxidation, respectively. Surprisingly, in addition to a cubic shape, particles of a latter powder have the plate-like and parallelepiped shapes.

Temperature dependences of the dielectric constant and losses for the doped samples exhibit a broad frequency dependent maximum, which can be attributed to a diffusive type phase transition. The polarization loops registered at room temperature indicate the increase of conductivity upon doping.

1. Golovina I.S., Geifman I.N., Rodionov Ye.V. Dielectric resonators for EPR spectroscopy - Kiev. Institute of Semiconductor Physics of NASU.- 2015.- 158 p.
2. Andriiko O.O., Kovalenko I.V., Chernenko L.V., Khainakov S.A., Golovina I.S., Geifman I.N. The synthesis of nanosized potassium metatantalate in molten nitrate environment // Naukovi visti NTUU "KPI".- 2008.- N 1 (57). - P. 117-122.