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The crystal structure, microstructure, and dielectric properties of $BaTi_{1-x}Sn_xO_3$ (x = 0, 0.05 and 0.1) ceramics sintered in different atmospheres (air and Ar)

Andrej Garaj,[1] Nikola Cvjetićanin,[1] Smilja Marković[2]
[1] *Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia*
[2] *Institute of Technical Sciences of SASA, Belgrade, Serbia*

Due to specific dielectric and ferroelectric properties, functional ceramics based on barium titanate ($BaTiO_3$) have found application in semiconductor industries. Appropriate electrical properties of barium titanate-based materials, such as magnitude of relative dielectric permittivity and the Curie temperature, could be achieved by varying the sintering conditions (which influenced ceramics' microstructure) and/or by doping with various cations.
Here, we investigated an influence of sintering atmosphere (air and argon) on the crystal structure, microstructure, and dielectric properties of barium titanate-stannate (BTS; $BaTi_{1-x}Sn_xO_3$) ceramics. The BTS powders (with x = 0, 0.05 and 0.1; denoted BT, BTS5 and BTS 10, respectively) were synthesized by solid-state reaction technique. In the following, the powders were uniaxially pressed (P = 240 MPa) into cylindrical compacts (∅ 6 mm and $h \approx$ 2 mm) and sintered in SETSYS TMA (Setaram Instrumentation, Caluire, France) by heating rate of 10 °/min up 1420 °C and with dwell time of 2 hours. To establish the influence of a sintering atmosphere two sets of experiments were performed: (1) in air, and (2) in Ar. During sintering, the shrinkage was recorded in axial (h) direction. The crystal structure of BTS ceramics were studied at room temperature by X-ray diffractometry and Raman spectroscopy. The microstructure and chemical (Ti/Sn) composition were examined by SEM–EDS methods. The electrical measurements were made in air, at 1 kHz using a Wayne Kerr Universal Bridge B224; the measurements were done in cooling, from 160 to 20 °C. A profound effect of argon atmosphere on the magnitude of relative dielectric permittivity of sintered BTS ceramics has been found.