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Enhancement on thermoelectric properties of BaTiTaO by Ca doping

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Thermoelectric (TE) materials are characterised by their ability to directly transform heat into electric energy, thus making them suitable for energy harvesting/recovery applications. The performances of these materials is evaluated by the dimensionless figure-of-merit, ZT ($ZT=\alpha^2T/\rho\kappa$; T: Absolute temperature; α: Seebeck coefficient; ρ: electrical resistivity; κ: thermal conductivity).

Among promising ceramic n-type TE materials, ones based on TiO_x family are most studied due to their performances while they contain nontoxic and environment friendly substances as compared with other thermoelectric systems. They are characterised by a perovskite crystal structure with cubic, tetragonal or orthorhombic symmetry. These materials show very attractive thermoelectric properties when they sintered in reductive atmosphere, producing oxygen vacancies in their structure.

In this work the effects of different degree of Ca doping in Ba site on their microstructure and thermoelectric properties will be explored. The purpose of dopant implantation is mainly to modify the unit cell parameter through substituting cation with lower ionic radii ones. These adjustments will lead to increase the free charge carrier concentration, enhancing overall thermoelectric properties.

$(Ba1\text{-}xCax)yTi0.85Ta0.15O\delta$ ceramics (x = 0, 0.10, 015, and 0.20, y = 1-0.925) were prepared by solid-state reaction route and sintered in forming gas N_2/H_2 at 1350°C. Presented phases were identified from XRD recorded data while materials characterization have been done through microstructural studies (SEM/EDS), thermal analysis, measurements of electrical conductivity and Seebeck coefficient as function of temperature.