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Influence of the dopant content on the properties of the hafnium-modified barium titanate nanostructured ceramics sintered by spark plasma sintering method

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Abstract

Dense ceramics, structured at nanometer scale, were obtained from BaTi1-xHfxO3(BTH) powders (x=0;0.05;0.10;0.20) prepared by the Pechini method and sintered by spark plasma sintering method (SPS) at 1050oC and 1200oC for 2min.

BTH samples sintered by spark plasma presented single phase regardless the sintering temperature. BTH ceramics resulting from spark plasma sintering at 1050oC/2min have dense microstructures(relative density 96.3-98.2%)and fine granulated. Increasing the Hf content induce a slight decrease in the average grain size. BTH ceramics with x=0.05 show a tendency towards a bimodal particle size distribution (small majority grains of 150˜ 300 nm coexist with a smaller fraction of larger grains, of ~ ˜12.5 □m). Further increase of Hf ratio induces nanostructured microstructural refinement, as well as dimensional homogenization, so that BTH ceramics with x=0.10 and x=0.20 have a monomodal distribution, 62.8nm and 39.3nm, respectively. BTH samples sintered in spark plasma at 1200oC/2min are very dense, homogenous and have significantly higher granulation.

It was obtained higher permittivity over the whole investigated temperature range, regardless of the Hf concentation in the case of BTH ceramics sintered at 1200oC/2min. The dielectric losses present values □ <2% for non-doped ceramics and for samples with a higher Hf content (x = 0.10 and 0.20). The highest dielectric losses were recorded for BTH ceramics with x = 0.05, where the dielectric permittivity also recorded the highest values. It is assumed that for this composition, the drastic reduction of the granulation generates a very large interfacial polarization through the Maxwell-Wagner effect, which induces both permittivity and high dielectric losses. However, even in this case, the dielectric losses do not exceed 8%.

Regardless of the sintering technique used, the increase of the Hf ratio caused the shift of the paraelectric-ferroelectric phase transition to lower temperature values.

Biography

She studied at politehnica university of bucharest between 2004-2009, in 2013 has finished her PhD thesis with the title “environmental friendly BaTiO3 ceramics” and in 2015 the Postdoctoral scholarship. Team member in 9 research projects (including 3 internationals) obtained through competition, it is member in the romanian ceramic society and won a grant obtained through competition “ECerS-ACerS students exchange program – Grant to participate to the january 2017 ACerS winter workshop”. The main approach of Dr.Eng.Catalina-Andreea STANCIU is associate with preparation and characterization of electroceramics, electro-optics and optics materials. Her research activity was focused on both theoretical and applicative directions. Thus, in the basic research field, the topics of interest were related to the study of physical/chemical processes and formation mechanisms in some oxide compounds, phase equilibria in advanced ceramics, size effects, defect chemistry, phase transitions and grain boundary phenomena in some micro and nanostructure ABO3 compounds with the perovskite structure ceramics.

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