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New Frontiers in Multifunctional Material Science and Processing

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Microstructure Samples Preparation and Analysis on the Way for Statistical and Fractals Applications

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The new correlation between microstructure and dielectric properties of doped $BaTiO_3$-ceramics based on fractal geometry and contact surface probability has been developed.

The doped $BaTiO_3$-ceramics using in this investigation has been prepared by a conventional solid state reaction. The content of additive oxides, Ho_2O_3, are ranged from 0.05 to 1.0 at%. The samples were sintered at 1320° and 1350°C for two hours with heating rate of 300°C/h in the air atmosphere. The microstructures of the as sintered or chemically etched samples were observed by using scanning electronic microscope JEOL-JSM 5300 equipped with energy dispersive spectrometry EDS (QX 2000S) system.

By using the fractal analysis and statistics methods of the grains contact surface, a reconstruction of microstructure configurations, like grains shapes, or intergranular contacts has been successfully done. The presented results indicate that fractals analysis and statistics model of different shapes of contact surfaces are very important for prognosis of $BaTiO_3$-ceramics microstructure and dielectric properties. The morphology of sintered $BaTiO_3$-ceramics grains points out the validity of developing new structure analytical methods based on different geometries of grains' model systems. The grains contact models based on ellipsoidal geometry is presented as a new modeling tool for structure research of $BaTiO_3$-ceramics materials. The directions of possible materials properties prognosis are determined according to the correlations synthesis-structure-property.

Keywords: microstructure, fractals, stat analysis, correlation: synthesis-structure properties