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Structural, dielectric and impedance study of a new lead free ferroelectric (Ba, M) (Ti, M') O3, M=Ca; Sr and M'= Sn; Zr ceramics

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The dielectric properties and microstructure of co-doped B-site and A-site BaTiO3 solid solution of the type (Ba, M) (Ti, M') O3 were investigated. The influence of extremely small amount of Sr, Sn, Zr and Ca dopants on the microstructure and the dielectric characteristics of BaTiO3 were studied systematically. These compositions were designed using the conventional mixed oxide technique and the XRD analysis results indicated that no secondary phase was formed. The microstructure of sintered pellets was studied by SEM at room temperature. The dielectric measurements showed that the BSTZ ceramic present the highest permittivity at 25°C and 100kHz with the value of 2600, whereas the crystallite size was found to approach 32.3 nm. The BaTiO3 ceramic with Sr at A-site has no phase transition above room temperature, while ceramics with Sn at B-site present ferroelectric – para-electric transition with sharp transition. Finally, the ceramic with Zr at B-site exhibit normal ferroelectric-para-electric transition with Tc=97°C. The effect of doping was been studied and analyzed using the AC complex impedance spectroscopy technique to obtain the electrical parameters of polycrystalline samples in a wide frequency range at different temperatures. The piezoelectric properties were also studied.

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Structural evolution of pearlite in steels with different carbon content under drastic deformation during cold drawing

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Steel wires, under severe cold drawing deformation, develop high strength. High carbon steel (C>0.80%) has a great demand in the steel market because of the extremely high strength (5-6 GPa). For this reason, it is relevant to increase the knowledge on the structural evolution and deformation mechanisms involved during wiredrawing process due to their critical applications, among which we can mention wires for: Bridges, cranes and tire cord. The mechanical behaviour aptitude is determined by torsion test. When the fracture surface is flat, the wire is apt. On the opposite, an irregular fracture surface (delamination) means poor mechanical properties. This paper presents a comparative study on steel wires (0.80% C) that presented normal behaviour and delamination problem during torsion test, in order to compare the structural evolution at high deformation. The deformation mechanisms and cementite stability was analyzed. The microstructural study was carried out applying light and Scanning Electron Microscopy (SEM). Finally, the structural information was correlated with results of Differential Scanning Calorimetry (DSC) and thermodynamic properties obtained by Fact Sage simulation. The structural study verified the presence of curling phenomenon in both steels products. It was possible to verify differences (~26%) in the interlaminar spacing (λ) of the pearlite between wires that present normal and delaminated behaviour under torsion test. The ductility loss (in the delaminated wire) is promoted by multiple causes: Higher interlaminar spacing, high nitrogen content in the product and the presence of dynamic strain aging, which is promoted by cementite destabilization and the formation of ε carbide.

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