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INFLUENCE OF ATTRITION MILLING ON BARIUM TITANATE PROPERTIES

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Barium titanate (BT) as the ferroelectric material is a good candidate for variety of applications due to its excellent dielectric, ferroelectric and piezoelectric properties. In this work barium titanate powder was prepared by soft chemical process from polymeric precursors (modified Pechini process). The obtained BT powder was nanosized with primary particles ~ 74 nm, but factor of agglomeration (F_{agg}) pointed on presence of agglomerates ~ 6 μm. It is well known that agglomerates could influence on setback of materials structure and properties. In order to obtain the de-agglomeration of nanopowder and to improve BT properties, an attrition milling was performed. Barium titanate powder was treated in attrition mill with zirconia media for 1h in 2% polyacrylic acid. Milled powder (BTA) possessed particles ~ 50 nm and agglomerates size was reduced to ~ 690 nm. Specific surface area of milled powder was higher than in starting BT powder. To investigate the effect of milling on electrical properties of ceramics, both BT powders were uniaxially pressed and sintered at 1300 ^{o}C for 8 h in air. SEM micrographs showed polygonal grains with dimensions around 2 μm in both ceramics. On the other hand, density of ceramics obtained from milled powder was 95 % of theoretical value and 90 % for BT. Temperature dependence of relative permittivity showed three structural transitions characteristic for ferroelectric BT ceramics. The temperature transition from ferroelectric to paraelectric was found to be at 120 ^{o}C for BT and 122 ^{o}C for BTA. Dielectric constant value was around 6700 for BTA, which was much higher value in comparison with non-treated BT where permittivity was 1340. Dielectric losses were below 0.03 in both BT ceramics.