

Effect of BaO-Bi₂O₃-P₂O₅ Glass Additive on Structural and Dielectric Properties of BaTiO₃ Ceramics

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Abstract : The effects of xBi₂O₃-yBaO-zP₂O₅ (BBP) glass addition on the sintering, structural, and dielectric properties of BaTiO₃ ceramic (BT) are studied. The BT ceramic was synthesized by the conventional solid-state reaction method while the glasses BaO-Bi₂O₃-P₂O₅ (BBP) were elaborated by melting and quenching process. Different composites BT-xBBP were formed by mixing the BBP glasses with BT ceramic. For each glass composition, where the ratio (x:y:z) is maintained constant, we have developed three composites with different glass weight percentage (x = 2.5, 5, and 7.5 wt %). Addition of the glass helps in better sintering at lower temperatures with the presence of liquid phase at the respective sintering temperatures. The results showed that the sintering temperature decreased from more than 1300°C to 900°C. Density measurements of the composites are performed using the standard Archimedean method with water as medium liquid. It is found that their density and molar volume decrease and increase with glass content, respectively. Raman spectroscopy is used to characterize their structural approach. This technique has allowed the identification of different structural units of phosphate and the characteristic vibration modes of the BT. The electrical properties of the composite samples are carried out by impedance spectroscopy in the frequency range of 10 Hz to 1 MHz under various temperatures from 300 to 473 K. The obtained results show that their dielectric properties depend both on the content of the glass in the composite and the Bi/P ratio in the glasses.

Keywords : phosphate, glasses, composite, Raman spectroscopy, dielectric properties

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