

Ferroelectric and Dielectric Properties of Phosphate Bonded Barium Titanate

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Abstract: Dielectric ceramics have a wide field of applications including, but not limited to capacitors, piezoelectric devices, memory systems, and sensors. While critical to modern day devices, the ceramics are typically prepared using methods that require specific equipment and are very energy intensive – such as spark plasma sintering, microwave sintering or hot pressing. As an alternative to these methods, a new brand of ceramics has emerged: phosphate bonded ceramics (PBCs). PBCs are made by mixing powdered ceramic with aluminum phosphate dissolved in water, and pressed uniaxially. Afterwards, the ceramics are heated up to 300 °C to speed up the curing process. Main advantage of such ceramics is the ease of preparation. Additionally, no thermal treatment above 300 °C is performed, which prevents growth of grains and, in case of mixed ceramics, prevents interphasial reactions. However, the ceramics produced typically display lower density, and are more lossy.

In this work, PBCs of barium titanate were prepared and investigated. Three series of samples were prepared at varying pressure during pressing process – one with mean grain size of 700nm, and another with 300nm. A third series of samples was prepared at a constant pressure, but the grains of both sizes were mixed according to the formula $x300\text{nm_size_BTO} + (1-x)700\text{nm_size_BTO}$. After sample preparation, measurements of dielectric permittivity and ferroelectric properties were performed.

Keywords: Dielectric materials, barium titanate, phosphate bonded ceramics