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Microwave Assisted Synthesis and Characterization of Barium Titanate Nanoparticles for Multi Layered Ceramic Capacitor Applications

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ABSTRACT

Barium titanate is a common ferroelectric electro-ceramic material having high dielectric constant, with photorefractive effect and piezoelectric properties. In this research work, nano-scale barium titanate powders were synthesized by microwave assisted mechano-chemical route. Suitable precursors were ball milled for 20 hours. TGA studies were performed to study the thermal stability of the powders. The powders were characterized by XRD, SEM and EDX Analysis. Microwave and Conventional heating were performed at 1000ºC. The overall heating schedule was reduced by 8 hours in microwave heating thereby reducing the energy and time requirement. The nano-scale, impurity-free and defect-free microstructure was clearly evident from the SEM micrograph and EDX patterns. LCR meter was used to measure the dielectric constant and dielectric loss values at various frequencies. Microwave heated powders showed superior dielectric constant value with low dielectric loss which is highly essential for the fabrication of Multi Layered Ceramic Capacitors.

KEY WORDS: Barium titanate, dielectric constant, mechano-chemical route, microwave heating.

INTRODUCTION

The perovskite family includes many titanates used in various electro-ceramic applications, for example, electronic, electro-optical, and electromechanical applications of ceramics. Barium titanate (BT) is most widely utilized in the manufacturing of electronic components such as Multilayered Ceramic Capacitors (MLCCs), PTC thermistors, piezoelectric transducers, and a variety of electro-optic devices [Maison et al., 2003; Ohara et al., 2008]. In order to meet the consumer's demands, improvements are made in the dielectric characteristics of BT at a rapid rate. Efforts are being made to reduce the size and weight of all communication devices as small and as light as possible. Recently MLCCs with thin dielectric BT layers are required due to the miniaturization of advanced electronic