$BaTiO_3$/SU-8 Nanocomposite Dielectric for Inkjet Printing

Mustapha Muhammad, Ahsan Mian, Hong Huang

The persistent demand for flexible and wearable electronic components in healthcare, aerospace, media, and transit applications has facilitated the substitution of traditional electronics processes with printed electronics, which has been predicted to dominate the market in the coming years. Among the various printing methods, inkjet printing has recently gained popularity for printing electronics, particularly capacitors that require precise and complex structures on different substrates. Inkjet printing utilizes a micro dispensing additive technology, where liquid phase materials are dispensed through drop on demand (DOD) technique using conductive nanoparticle inks. Several researchers have attempted to fabricate fully inkjet print composite capacitors and discovered that the permittivity value of the composite increases compared to a polymer. These suggests that using composites as the dielectric material in a capacitor can potentially increase the capacitance value. However, among the spectra of composite dielectric materials that have been discussed, there is a scarcity of information on the use of BaTiO3/SU-8 dielectric materials for capacitor applications. As such, this study aims to formulate BaTiO3/SU-8 ink for inkjet printing and develop a printing process for layered metal-insulator-metal (MIM) structures. The formulated BaTiO3/SU-8 ink is utilized to print the dielectric material, while nano-silver ink is used for the two electrodes, enabling the capacitor fabrication in a single step. The study considers volume and speed jetting parameters to achieve ideal and uniform liquid phase material inkjet printing on the substrates. The thickness of the printed layers is measured using a profilometer, and the sheet resistance of the inkjet print nano-silver conductive ink is evaluated using a 4-point probe. The dielectric properties of the printed composite are characterized by measuring the capacitance value. This paper's objective is to provide insights into the formulation of BaTiO3/SU-8 dielectric materials and understand the processes involved in the fabrication of a fully inkjet print composite MIM capacitor. Finally, the experimental results will be compared with different theoretical models of BaTiO3/SU-8 capacitors from our research group.

Biography of Presenter

Mustapha Muhammad
MSc. Materials Science and Engineering, Wright State University

BSc. Metallurgical and Materials Engineering, University of Lagos