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Enhancement of Dielectric Constant in Polymer-Ceramic Nanocomposite for Flexible Electronics and Energy Storage Applications

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Abstracts: The polymer nanocomposites have potential applications in flexible electronics due to its interesting dielectric properties. Hence, flexible nanocomposite films of polyvinylidene fluoride (PVDF) polymer and barium hexaferrite (BHF) nanoparticles with high dielectric constant were prepared by the solution cast method. The dielectric behavior of the materials has been understood by employing the impedance spectroscopy techniqe. The co-existence of α and β phases of PVDF has been observed from the XRD (X-ray Diffractometer) and FTIR (Fourier-transform infrared spectroscopy) analysis. The ratio of α and β phases of PVDF has a great influence on dielectric, ferroelectric and energy storage density of PVDF-BHF nanocomposites and, it depends upon the concentration of BHF in the nanocomposites. FE-SEM (Field Emission Scanning Electron Microscopy) micrographs reveal that the microstructure of the composite depends upon the concentration of BHF in the PVDF matrix. Dielectric properties of nanocomposite highly depends on microstructure of the PVDF-BHF nanocomposite. This observation has been well explained by considering the BLCs (Barrier Layer capacitances) model. Interestingly, the dielectric constant has been enhanced eighteen (18) times at 1KHz to that of dielectric constant of PVDF. The dielectric constant increases due to the electrostatics and interfacial interaction between the local electric field of the BHF nanoparticle and *CH2/CF2* dipole of PVDF chain. The present study opens a new window for the possible use of PVDF-BHF nanocomposite in dielectric and energy storage device applications.

Keywords: PVDF, nano filler, dielectric constant, energy storage density