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Electrical Properties of Cement-Based Piezoelectric Nanoparticles

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Abstract : Piezoelectric based cement nanocomposite is a promising technology for generating an electric charge upon mechanical stress of concrete structure. Moreover, piezoelectric nanomaterials play a vital role for providing accurate system of structural health monitoring (SHM) of the concrete structure. In light of increasing awareness of environmental protection and energy crises, generating renewable and green energy form cement based on piezoelectric nanomaterials attracts the attention of the researchers. Herein, we introduce a facial synthesis for bismuth ferrite nanoparticles (BiFeO3 NPs) as piezoelectric nanomaterial via sol gel strategy. The fabricated piezoelectric nanoparticles are uniformly distributed to cement-based nanomaterials with different ratios. The morphological shape was characterized by field emission scanning electron microscopy (FESEM) and high-resolution transmission electron microscopy (HR-TEM) as well as the crystal structure has been confirmed using X-ray diffraction (XRD). The ferroelectric and magnetic behaviours of BiFeO3 NPs have been investigated. Then, dielectric constant for the prepared cement samples nanocomposites (εr) is calculated. Intercalating BiFeO3 NPs into cement materials achieved remarkable results as piezoelectric cement materials, distinct enhancement in ferroelectric and magnetic properties. Overall, this present study introduces an effective approach to improve the electrical properties based cement applications.

Keywords : piezoelectric nanomaterials, cement technology, bismuth ferrite nanoparticles, dielectric
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