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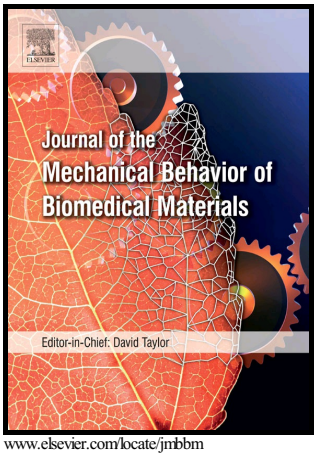

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Abstract

Post-surgical infection is one of the essential problems in bone scaffolds that is usually treated with antibiotics. This issue may be related to the poor blood supply for bone tissue due to high concentrations of drug. In the current study, the effect of zinc oxide (ZnO) nanoparticles on the antibacterial behavior of the nanocrystalline hydroxyapatite (n-HA) scaffolds coated by gelatin-ibuprofen (GN-IBO) is evaluated. To this end, the bio-nanocomposite scaffolds are fabricated via the space holder technique and then characterized with the aid of X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). The compressive strength, fracture toughness, porosity, elastic modulus as the mechanical properties, and the apatite formation, biodegradation, drug release and wettability beside the roughness as the biological properties are predicted. The obtained experimental results indicate that the bio-nanocomposite scaffolds containing 10 wt% ZnO has suitable mechanical and biological properties. After that, an analytical model is developed to predict the nonlinear instability and vibration responses of an axially loaded sandwich plate-type implants made of the fabricated n-HA-ZnO bio-nanocomposites coated by GN-IBO thin film corresponding to various weight fractions of ZnO nanoparticles. It is found that ZnO peaks in the positions of 2θ are equal to 31.6°, 33.6°, 34°, 46.4°, and 62°, which represent the crystalline characteristics. Also, it is revealed that through addition of ZnO nanoparticles, the hardness and elastic modulus as well as the bone formation and biodegradation rate of the bio-nanocomposite scaffold enhance, while its drug release in the phosphate buffer solution detected with UV spectrum reduces. It is found that by increasing the ZnO weight fraction, the critical axial buckling load of the sandwich bio-nanocomposite implant enhances, and it buckles at lower axial