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The effect of MgO on the biodegradation, physical properties and biocompatibility of a Mg/HA/MgO nanocomposite manufactured by powder metallurgy method

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Abstract

Recently, magnesium-hydroxyapatite composites have shown the potential to serve as biodegradable metal matrix composite implants that can repair load-bearing defects in osseous tissue. However, the mechanical properties and corrosion resistance of magnesium-hydroxyapatite composites have been restricted by the significant agglomeration of HA particulates. In this study, the bio-corrosion properties of a Mg/HA-based composite were improved by the addition of different amounts of hydroxyapatite (HA) and periclase (MgO) nanopowders to pure magnesium and fabrication of the Mg/HA/MgO nanocomposites using a blend-cold press-sinter powder metallurgy (PM) technique. X-ray diffraction, X-ray photoelectron spectroscopy, transmission electron microscopy, atomic force microscopy and field-emission scanning electron microscopy were used to characterize the compositions of the corrosion products and the surface morphologies of the corroded specimens. Based on the electrochemical test, the corrosion resistance of the nanocomposites is shown to increase from $0.25 \text{ k}\Omega \text{ cm}^2$ to $1.23 \text{ k}\Omega \text{ cm}^2$ with the addition of 10 wt% MgO; however, the ultimate compressive strength decreased from ~ 237 to ~ 198 MPa. During immersion test in SBF solution, the growth of the $\text{Mg}(\text{OH})_2$ nanorods on the Mg-12.5HA-10MgO and Mg-5HA-15MgO (wt%) nanocomposites increased the contact angle between the SBF

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