Accepted Manuscript

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

Shahrouz Zamani Khalajabadi, Mohammed Rafiq Abdul Kadir, Sudin Izman, Mohsen Marvi

PII: S0925-8388(15)31083-5

DOI: 10.1016/j.jallcom.2015.09.107

Reference: JALCOM 35382

To appear in: *Journal of Alloys and Compounds*

Received Date: 2 July 2015

Revised Date: 6 September 2015

Accepted Date: 13 September 2015

Please cite this article as: S.Z. Khalajabadi, M.R. Abdul Kadir, S. Izman, M. Marvi, The effect of MgO on the biodegradation, physical properties and biocompatibility of a Mg/HA/MgO nanocomposite manufactured by powder metallurgy method, *Journal of Alloys and Compounds* (2015), doi: 10.1016/j.jallcom.2015.09.107.

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

Shahrouz Zamani Khalajabadi[a], Mohammed Rafiq Abdul Kadir[a,*], Sudin Izman[b], Mohsen Marvi[a]

[a] Medical Devices & Technology Group (MEDITEG), Faculty of Biosciences and Medical Engineering, Universiti Teknologi Malaysia (UTM), 81310 Skudai, Johor Bahru, Johor, Malaysia

[b] Department of Materials, Manufacturing and Industrial Engineering, Faculty of Mechanical Engineering, Universiti Teknologi Malaysia (UTM), 81310 Skudai, Johor Bahru, Johor, Malaysia

Corresponding author: Mohammed Rafiq Abdul Kadir
E-mail addresses: rafiq@biomedical.utm.my (M.R.A. Kadir), shahroozzamany@yahoo.com
Tel.: 0060-137585553; Fax: 0060-7 5536222

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 kΩ cm^2 to 1.23 kΩ 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 $Mg(OH)_2$ nanorods on the Mg-12.5HA-10MgO and Mg-5HA-15MgO (wt%) nanocomposites increased the contact angle between the SBF