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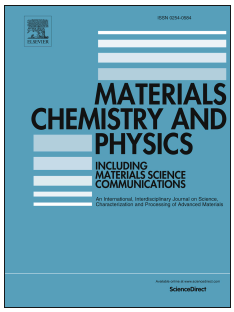

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PII: S0254-0584(18)30742-9

DOI: 10.1016/j.matchemphys.2018.08.077

Reference: MAC 20920

To appear in: *Materials Chemistry and Physics*

Received Date: 3 April 2018

Revised Date: 22 July 2018

Accepted Date: 24 August 2018

Please cite this article as: S. Kamali, S. Shemshad, A. Khavandi, S. Azari, Construction novel hydroxyapatite-nitinol nanocomposite for hard tissue applications, *Materials Chemistry and Physics* (2018), doi: 10.1016/j.matchemphys.2018.08.077.

Construction Novel Hydroxyapatite-Nitinol nanocomposite for hard tissue applications

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Abstract

Natural Hydroxyapatite (HA)- Nitinol (NiTi) nanocomposites with different percentage of NiTi were fabricated by powder metallurgy. The structural stability of HA phase in HA- NiTi samples and mechanical strength of nanocomposites were studied by FTIR, XRD and compression test. In addition, biological behavior of the composites were investigated by in vitro studies. The existence of NiTi metal phase can promote dehydration and decomposition of HA ceramic phase into more stable calcium phosphate phases at high temperatures. According to results that obtained, the nanocomposite sample with 10wt.% NiTi has the maximum compressive strength (67.67 MPa) compare to pure HA ceramic (46 MPa) that manufactured under the same condition. Crack deflection is the chief strength mechanism in the nanocomposites. in vitro studies showed that MG-67 osteoblast cells attached and spread on the surface of the sample. The results revealed that nanocomposite with 10wt.% NiTi has a good mechanical strength and suitable biological behavior that can be used in medical applications.

Keywords

Hydroxyapatite, Nitinol, ceramic, nanocomposite

1. Introduction

Hydroxyapatite (HA, $Ca_{10}(PO_4)_6(OH)_2$) is a unique ceramic material with chemical composition and crystallographic structure similar to the mineral phase of the bone[1]–[3]. It has excellent properties such as bioactivity, biocompatibility and the ability to form a strength bone- bond with other tissues through an osteoconductive mechanism[4]–[6]. Therefore, in terms of biocompatibility, hydroxyapatite seems an appropriate ceramic for hard tissue replacement[7]. But, its brittleness and low mechanical strength in tension, prevent its clinical use as