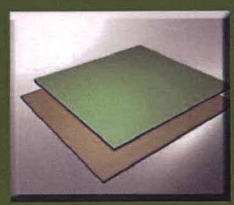
# ADVANCES IN COMPOSITE MATERIALS



Iskandar Idris Yaacob
Md Abdul Maleque
Zahurin Halim

IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

# ADVANCES IN COMPOSITE MATERIALS

Iskandar Idris Yaacob
Md Abdul Maleque
Zahurin Halim

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011


Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Iskandar Idris Yaacob, Md Abdul Maleque & Zahurin Halim: Advances in Composite Materials.

ISBN: 978-967-418-231-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
**IIUM PRINTING SDN. BHD.**
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

# Table of Content

Chapter 028

# Manganese Doped Hydroxyapatite Powder through Hydrothermal Method

Asep Sofwan Faturohman Alqap[1], Iis Sopyan[1] and Nuur Izzati Mazmaa[2]
[1,2]Khulliyyah of Engineering – International Islamic University Malaysia
✉ : sopyan@iium.edu.my; asepsofwan4@gmail.com

**Keywords:** Hydroxyapatite; β-Tricalcium phosphate; manganese; Ca-Deficient hydroxyapatite; β-TCP Promoter; hydrothermal; synthesis.

**Abstract:** Hydroxyapatite ceramic is good in biocompatibility and bioactivity. Manganese dope is defective for hydroxyapatite. By 1% of $MnO_2$ mol Ca-deficient hydroxyapatite can be better in crystallinity by heating up to 700°C however the heating beyond of this transformed it to β-tricalcium phosphate. Increasing in manganese, Ca-deficient hydroxyapatite did not withstand appearing under heating and transformed to more amorphous feature and to β-tricalcium phosphate. Mn was favor for β-tricalcium phosphate.

## Introduction

Hydroxyapatite, HA ($Ca_{10}$ $(PO_4)_6(OH)_2$), is a calcium phosphate-based compound classified as a bioceramics. Various studies showed evidence that HA has good biocompatibility and bioactivity. It generally accepted that the human bone is composed of 70% mineral and 30 % organic compound, where 95% of the mineral phase is HA. This greatly contributes to the performance in HA in biological studies. HA can be used either as a bone graft or a coating material. As bone graft, it is being used either as dense or porous grafts. However, HA have some mechanical limitations because it is brittle. Therefore for load bearing application, HA coatings on metals for example have been developed to enhance the mechanical properties of HA. Biological and physicochemical properties of HA can be improved by the substitution with ions usually present in natural apatites of bone. Most natural apatites are non-stoichiometric because of the presence of minor constituents such as cations ($Mg^{2+}$, $Mn^{2+}$, $Zn^{2+}$, $Na^{+}$, $Sr^{2+}$) or anions ($HPO_4^{2-}$ or $CO_3^{2-}$). Trace ions substituted in apatites can have effect on the lattice parameters, the crystallinity, the dissolution kinetics and other physical properties of apatites [1, 2].

Hydrothermal processing can be defined as any homogeneous (nanoparticles) or heterogeneous (bulk material) reaction in the presence of aqueous solvents or mineralizers under high pressure and temperature conditions to dissolve and recrystallize (recover) materials that are relatively insoluble under ordinary conditions in a closed system [2]. However other used this term for normal pressure even closer to 1 atm. The hydrothermal technique has a lot of advantages like it accelerates interactions between solid and fluid species, phase pure and homogeneous materials can be achieved, reaction kinetics can be enhanced, the hydrothermal fluids offer higher diffusivity, lower viscosity, facilitate mass transport and higher dissolving power. Most important is that the chemical environment can