ADVANCES IN MATERIALS ENGINEERING

Volume 2

Edited By:
Md Abdul Maleque
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Table of Content

Chapter 008

Effect of Sintering Temperature on Protein Foaming-Consolidation Porous Alumina-tricalcium Phosphate Composites

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Abstract. In this chapter, porous alumina-tricalcium phosphate (TCP) composite bodies were designed for use in bone implant via protein foaming-consolidation method and the effect of sintering temperature was investigated. Hydrothermal derived TCP powder was used as bioactive ceramic. Alumina and TCP powders were mixed with yolk, starch and darvan 821 A at an adjusted mass ratio to make slurry. The slurries were cast into cylindrical shaped molds and then dried for foaming and consolidation process. Subsequently, the dried bodies were burned at 600°C for 1 h, followed by sintering at temperatures of 1,200, 1300 and 1400°C for 2 h. The results show that the sintered bodies were porous with pore size in the range of 50-600 μm and densities of 2.7 – 2.9 g cm^{-3}. Increasing sintering temperature from 1,200 to 1,300°C improved compressive strength from 23.6 MPa to 41.0 MPa, and it reduced again to 18.0 MPa when sintered at 1400°C. XRD pattern results show intensity of TCP phase in bodies increased with sintering temperatures and also found that the sintering processes did not alter phases in the porous bodies.

Introduction

Implantation of bone by using bone grafts is known strategies for treatment of large bone defects which all lead to limited degree of structural and functional recovery. However, limited supply, donor site morbidity and risk of transmission of pathological organisms impose major limits to their widespread use [1]. Bone implants become an important thing in the biomedical implant market due to all of the problems arise in the medicine today. To date, several bone substitutes have been approved for clinical applications using a wide range of scaffold materials. In orthopedic applications, a range of bioactive ceramics such as tricalcium phosphate (TCP), hydroxyapatite (HA), bioglass and glass ceramics have been employed because of their excellent bioactivity and bone bonding ability. However, most of them have relatively poor mechanical strength and they cannot meet the requirements for many applications [2].

Alumina is used to make implantable orthopedic devices, is a very well tolerated material with minimum tissue reaction after implantation. It exhibits high mechanical strength and