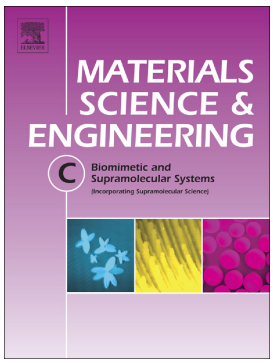

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Comparative study on Ti-Nb binary alloys fabricated through spark plasma sintering and conventional P/M routes for biomedical application

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ABSTRACT

The main purpose of this work is to obtain homogenous, single β phase in binary Ti-xNb (x = 18.75, 25, and 31.25 at.%) alloys by simple mixing of pure elemental powders using different sintering techniques such as spark plasma sintering (pressure-assisted sintering) and conventional powder metallurgy (pressure-less sintering). Synthesis parameters such as sintering temperature and holding time etc are optimized in both techniques in order to get homogenous microstructure. In spark plasma sintering (SPS), complete homogeneous β phase is achieved in Ti25at.%Nb using 1300 °C sintering temperature with 60 min holding time under 50 MPa pressure. On the other hand, complete β phase is obtained in Ti25at.%Nb through conventional powder metallurgy (P/M) route using sintering temperature of 1400 °C for 120 min holding time which are adopted from the dilatometry studies. Nano-indentation is carried out for mechanical properties such as Young's modulus and nano-hardness. Elastic properties of binary Ti-xNb compositions are fallen within the range of 80-90 GPa. Cytotoxicity as well as cell adhesion studies carried out using MG63, osteoblast-like cells showed excellent biocompatibility of thus developed Ti25at.%Nb surface irrespective of fabrication route.

Keywords: Biomedical Applications, Dilatometry, Nano-indentation, Powder Metallurgy, Spark Plasma Sintering, β Ti Alloys.

1. INTRODUCTION

In the last few years, titanium (Ti) alloys are emerged as orthopedic implants owing to their favorable mechanical properties such as high strength-to-weight ratio, good wear and corrosion resistant properties along with excellent biocompatible properties [1-3]. Among Ti alloys, Ti-6Al-4V is the first commercial metallic implant material which was originally developed for aerospace applications [4]. Due to potential problems associated with Al and V, considerable research has been focused on developing Ti alloys

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