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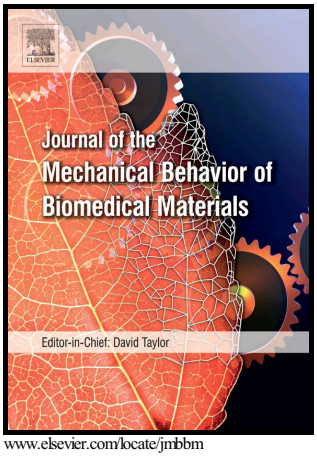

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Mechanical Properties and Electrochemical Behavior of Porous Ti-Nb Biomaterials

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Abstract

Ti-Nb-based alloys – with their superior mechanical properties and biocompatibility – are attractive biomaterials for orthopedic implants. By producing this alloys with a porous structure, it is possible to achieve mechanical properties similar to that of bone and to facilitate cellular activities. In this study, Ti16Nb (wt. %) alloys containing porosity between 4.05-% and 60.79-% were produced by powder metallurgy using different amounts of space holder materials. The samples were sintered at 1200°C for 3 h in a high-level vacuum. The effects of the space holder content – in terms of mechanical properties, amount and morphology of the pores, density and the corrosion behavior of the Ti16Nb alloy – were investigated. It is seen that the addition of 70 vol. % space holder materials to the Ti16Nb alloy leads to a decrease in the density value from 4.67 g/cm^3 to 1.91 g/cm^3. Also, it is observed that by producing Ti16Nb with 70 vol. % space holder, elastic modulus, compressive and transverse rupture strength values decreased from 96 GPa to 15 GPa, from 1450 MPa to 100 MPa, and from 1173 MPa to 97 MPa, respectively. Although Ti16Nb porous alloys are designed by imitating the properties of the cortical bone for use in the production of load-bearing implants, it is seen that increasing the amount of pores causes, an increase in the corrosion rate and the corrosion current density and a decrease in the polarization resistance.

Keywords: Biomaterials, Titanium alloys, Porosity, Mechanical properties, Corrosion

1. Introduction