8vo Congreso Latinoamericano de Órganos Artificiales, Biomateriales e Ingeniería de Tejidos

8vo COLAOB

20 - 23 Agosto de 2014
Rosario - Argentina

2B-52

MORPHOLOGICAL AND SURFACE EVALUATION OF Ticp AND Ti-13Nb-13Zr ALLOY OBTAINED BY POWDER METALLURGY

Agreda C G. [1], Ribeiro C. [2], Barros G. S [2], Bressiani A .H.A.[1]
[1]Instituto de Pesquisas Energéticas e Nucleares- Centro de Ciência e Tecnologia de Materiais (CCTM). CEP 05508-000, São Paulo, SP, BRASIL
[2] Universidade Federal do ABC-Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas- CEP 09606-070 – São Bernardo do Campo, SP, BRASIL

The formation of a mineralized bone matrix in implants depends on a set of events able to establish a suitable interface between the implant-tissue, defining its morphological and surface biocompatibility. These precursors' events of tissue formation are greatly influenced by the characteristics of its surface as chemical composition, surface energy, wettability and texture that means a combination of topography and roughness. Despite advances in surface engineering, there is still no definition of an ideal pattern for surface configuration, aiming enhanced performance of an implant. It has been currently argued that metallic biomaterials, in particular, as the Ticp and its alloys such as Ti-13Nb-13Zr are characterized by superior resistance to corrosion and suitable elastic modulus, it is known that elements such as niobium and zirconium also have an important role in the biological performance.

The purpose of this study was to evaluate the morphological and surface differences between samples Ticp and Ti-13Nb-13Zr and the influence of these characteristics on predicted "in vivo" compatibility. The samples were processed by powder metallurgy using flexible rubber molds containing the TiH powder for obtaining Ticp and mixing the metal powders to obtain the alloy. The materials were isostatically pressed at 200MPa and sintered at 1400°C/1h - Ticp and 1300^{o}C/3h - alloy, resulting in 88% of theoretical density for both samples, measured by the Archimedes method.

The surfaces were investigated, grounded in the wettability degree expressed by contact angle measurements performed at room temperature, using distilled water as fluid deposition, roughness data were also obtained using surface roughness tester in polished surfaces of the samples, performing scans in 3 different directions on each side for the same group of samples, and the presence of functional groups on the surface was evaluated by diffuse reflectance spectroscopy on the infrared (DRIFT). Morphological analysis of the surfaces was also performed by optical and scanning microscopy (SEM) for show the microstructure.

Ticp microstructure was suitable to note the presence of Tiα phase and residual porosity and the alloy microstructure release the typical structure of Widdmanstatten (phases α and β) with structural homogeneity and residual porosity.

The analysis topography of the samples may suggest a very positive factor and permissive to osseointegration, with the samples obtained by powder metallurgy showed higher roughness values than commercial Ti implants, providing greater mechanical retention and better performance in cell adhesion.

The results showed strong influence of alloy elements on the wettability of the surface, rendering it more hydrophilic, and suggesting greater ease of interaction to alloy compared to Ticp. It was also noted that the processing conditions that define different microstructures for the alloy and Ticp, suggesting particular patterns of roughness highly attractive for cellular components adsorption and subsequent osseointegration, according to good performance of the analyzed implants.