Evolution of oxide film on the internal porosity of Ti-30Nb-13Ta-2Mn alloy foam

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Abstract

Porous Ti-based alloys are currently considered for application in biomedical implants owing to similarity of their mechanical properties with those of human bone, potentially eliminating the risk of so-called stress shielding. In this work, Ti-30Nb-13Ta-2Mn at.% porous alloy, also referred to as foam, was obtained by the powder metallurgy approach using (NH4)2(CO3) as space-holder. The foam samples were immersed to simulated body fluid after 504?h?at 37?°C and the effect of exposure was evaluated by using electrochemical techniques. In addition, microstructure was examined by means of scanning electron microscopy, X-ray diffraction, Archimedes method and nitrogen adsorption isotherms analyzed according to the Brunauer–Emmett–Teller theory. The results revealed two pore size distributions that are modified distinctively during exposure. Whereas macroporosity decreased consistently in time, microporosity evolved to a stable structure in the first hour of exposure to produce an active area of 0.57?m2/g. The electrochemical analysis revealed a passive behavior evolving during exposure due to competitive formation and dissolution of corrosion products at the pores. It is concluded that macroporosity alone is insufficient for explaining corrosion performance of the alloy foam..

Keywords

Ti-based alloy, Porous electrode, Oxide, Biomaterials, Implants.