CORROSION RESISTANCE STUDY BY ELECTROCHEMICAL METHODS, OF THE Ti6Al4V ALLOY SINTERED BY PULSED ELECTRIC CURRENT (SPS)

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Palavra chave: Ti6Al4V, harmonic structures, corrosion resistance, electrochemical methods

Resumo: Ti6Al4V material is a titanium alloy long recognized and used in biomedical applications due to its excellent corrosion resistance, high mechanical strength-to-weight ratio and good biocompatibility. In recent years, research has shown great advances in the material's strength and ductility, due to a harmonic microstructure obtained by mechanical grinding and SPS (Spark Plasma Sintering) sintering powders obtained by PREP (Plasma Rotating Electrode Process). By using this biomaterial with better mechanical properties, the main objective of this study is to evaluate the corrosion resistance and electrochemical stability of this alloy Ti6Al4V sintered in comparison with the commercial alloy Ti6Al4V obtained metallurgically, for the purpose of orthopedic implants. To perform this study were used Ti6Al4V test pieces sintered by SPS at approximately 5 mm high and 20 mm in diameter, obtained in the sintering cycles carried out at 800°C and 900°C for 10 minutes under 50 MPa compression pressure. For comparison, commercial Ti6Al4V samples were used. The microstructure of these materials was examined using an optical microscope and X-ray diffraction technique, which detected the presence of alpha phase (?-CH), alpha-beta phase (? + ?) and beta phase (?-ccc) for all samples. The morphology was analyzed by scanning microscope and for the study of the thermodynamic and electrochemical stability of the materials it was used the open circuit potential (OCP), the linear sweep voltammetry (LSV) and electrochemical impedance spectroscopy (EIS) techniques, in solution of artificial blood. The harmonic structure obtained at 800°C, consisted of a three-dimensional network structure with more coarse-grained regions surrounded by regions of finer grains, confirms the balance between the mechanical properties and ductility of the sintered alloy Ti6Al4V. This alloy sintered at 800°C showed high corrosion resistance and good thermodynamic stability, when compared to commercial alloy in an environment containing chloride ions. This fact was confirmed by obtaining higher stability potential, and the EIS technique showed that the system Polarization resistance was around 106?cm2. Therefore by controlling the system on micrometric scale with harmonic structures there was obtained the best results and improvements on the mechanical properties, good surface stability, and corrosion resistance of the sintered biomaterial.