Microstructural characterization and corrosion behavior of the Ti-22Si-11B alloy prepared by ball milling and subsequent spark plasma sintering

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Titanium alloys are widely used for dental, medical, and aerospace applications due to their chemical, physical, and mechanical properties [1,2]. Orthopedic Ti–10Si–5B implants present good bone compatibility as well as the Ti+Ti_6Si_2B alloys exhibit higher oxidation resistance than the Ti+Ti_5Si_3 alloys [3,4]. Ball milling can produce homogeneous and metastable materials whereas the dense sintered samples are reached at short times during spark plasma sintering (SPS). In this way, the corrosion behavior of mechanically alloyed and sintered Ti-22Si-B alloy was evaluated in according to the AFNOR NF S91-141 artificial saliva, ASTM B117 saline, and AFNOR S90-701 simulated body fluid standard procedures using the open current potential (OCP) and potentiodynamic polarization methods. The elemental Ti-22Si-11B powder mixtures (at-%) were processed for 90 h in a planetary Fritsch P-5 ball mill under argon atmosphere using stainless steel vial (225 mL) and balls (10 mm diameter), rotary speed of 150 rpm, and a ball-to-powder weight ratio of 2:1. After milling the powders were sintered in a DR. SINTER type SPS 3.20MK-IV (Sumitomo Coal Mining, Japan). SPS samples presented microstructures based on the Ti_6Si_2B phase as matrix belong the small amounts of Ti and TiB precipitates was confirmed by scanning electron microscopy (SEM), X-ray diffraction (XRD), and energy dispersive spectrometry (EDS). The results also indicated that the corrosion resistance is increased with the increasing of Ti_6Si_2B in alloy. The authors thank FAPEMIG, CNPq, CAPES and FAPESP for the support they have received in their research.

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