(301-240) - Corrosion behavior of Ti-13Nb-13Zircaloy-4 alloy produced by Powder Metallurgy

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PWR power reactors installed in Brazil use uranium dioxide (UO2) pellets contained in Zircaloy-4 (Zr-4) rods as nuclear fuel for electricity generation. Zircaloy is a Zirconium based alloy widely used in nuclear reactors due to its satisfactory mechanical strength, high temperature and corrosion resistance and low neutron absorption cross-section. Zirconium based alloys are not manufactured in Brazil, and therefore, Zr-4 used in power plants are imported. During fabrication process of fuel elements, great amounts of Zr-4 residues are produced, mainly in the machining stage. As this material can't be discarded as common metallic residue, recycling assumes a strategic role in economic and environmental aspects of Brazilian Nuclear Politics. In this present work Ti-13Nb-13Zr(Zr-4) alloy was produced by powder metallurgy (PM) using Zr-4 for substitution of Zirconium, as an alternate viable route for recycling of this material. Hydrogenation-dehydrogenation (HDH) process was used to produce Zr-4 powder from machining residues. Titanium, Niobium and Zirconium hydrided elemental powders were produced using same route. Powders were submitted to high speed planetary ball milling, cold isostatic pressing and sintering under high vacuum. The corrosion behavior of Ti-13Nb-13Zr and Ti-13Nb-13Zr-4 (%wt) was investigated analyzing corrosion potential variation with time, potentiodynamic polarization curves and electrochemical impedance spectroscopy using Hank's solution as simulated body fluid.