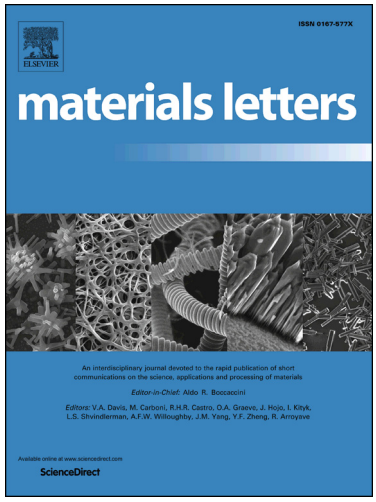

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Influence of High Pressure Torsion on structure and properties of Zr-Ti-Nb alloy synthesized from TiH_2, ZrH_2 and Nb powders

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Abstract: The effects of High Pressure Torsion (HPT) deformation on the microstructure and mechanical properties of a corrosion-resistant, low modulus Zr-Ti-Nb alloy, obtained by vacuum sintering of cold pressed powder are studied. It is shown that HPT treatment leads to the following effects: elimination of the residual chemical heterogeneity of the alloy, significant reduction of the porosity of the material and the pore size and improvement of mechanical properties. The phase composition of the alloy does not change during processing. The results show the potential of the HPT method for the production of alloys with a favorable combination of properties.

Keywords: Nano-Crystalline Metals, Phase transformations, Microhardness, Sintering, Shear deformation, High pressure torsion.

1. Introduction

Ti–Zr–Nb alloys have a high potential as structural materials for chemically-aggressive environment [1-5]. The Ti–Zr binary system is the base for a large number of alloys used in medical applications, since they have sufficient resistance to alkaline and acidic media and high biocompatibility as well as strength level. The addition a sufficient amount of elements (such as Nb and Ta) to the binary Ti–Zr alloys, stabilizing the high-temperature bcc β-phase, provides the required balance of strength and plasticity. It allows also to control in a wide range the elastic modulus of the alloys. As an example, the addition of Nb reduces the Young's modulus of Ti–Zr alloy from 95–110 GPa to 50–60 GPa and even lower [1-2, 4, 6], bringing its values closer to the corresponding characteristic of bone tissues. This is necessary for mechanical compatibility of medical implant materials. This feature also can be used in the manufacturing of elastic elements for various applications.