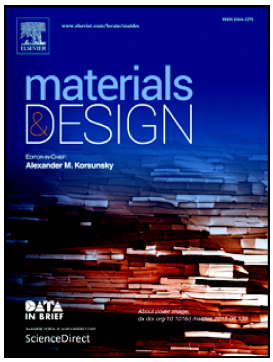

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PII: S0264-1275(16)31515-5
DOI: doi: 10.1016/j.matdes.2016.12.004
Reference: JMADE 2549

To appear in: *Materials & Design*

Received date: 17 October 2016
Revised date: 18 November 2016
Accepted date: 1 December 2016

Please cite this article as: J. Shen, B. Chen, X. Ye, H. Imai, J. Umeda, K. Kondoh , The formation of bimodal multilayered grain structure and its effect on the mechanical properties of powder metallurgy pure titanium. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jmade(2016), doi: 10.1016/j.matdes.2016.12.004

The formation of bimodal multilayered grain structure and its effect on the mechanical properties of powder metallurgy pure titanium

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Abstract

In the present work, we report a novel bimodal and multi-layered grain structure in pure titanium produced via powder metallurgy. It was found that the hot-extruded pure Ti consists of multiple grain layers, which exhibited substantially different mean grain sizes. The microstructural development during hot extrusion was then investigated for the pure Ti via an interrupted extrusion experiment. The influence of this unique structure on the mechanical properties of the material was also studied under uniaxial quasi-static tension. The experimental results showed that the samples with different arrangement of the grain layers exhibited very different mechanical behavior. Namely, with combining a small part of fine grain layers, the material showed significantly increased yield strength and slightly decreased uniform plastic strain. Yet, the elongation-to-failure was decreased markedly for the multilayered material. Postmortem examinations indicated that this may attribute to the absence of deformation twins in the fine grains that leads to formation of microvoids, which finally develop into large cracks.

Keywords: Titanium, Powder consolidation, Dynamic recrystallization, Multilayer structure, Deformation twinning

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