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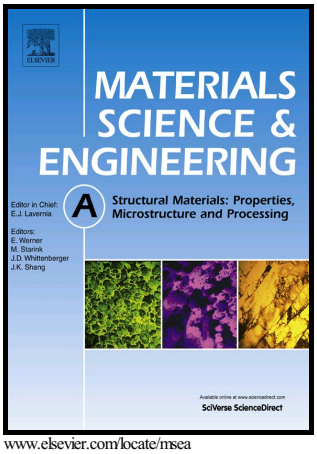

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Abstract
In this paper, a new method of manufacturing nanostructured titanium (n-Ti) is presented. An effective way of grain refinement and strengthening a material using conventional plastic working is proposed. Microstructured titanium (m-Ti) Grade2 was processed using caliber rolling technology. In this work, the m-Ti billet in the initial state was in the form of a rod with a diameter of 10mm. This billet was subjected to multi-pass longitudinal cold caliber rolling, during which the transverse section of the rod was gradually reduced. The rolling was carried out in such a way as to accumulate a relatively large plastic deformation in the workpiece. The rolling process resulted in a refinement of the microstructure into a nanostructure. The average grain size of 74nm and enhanced mechanical properties were obtained. This single-phase Ti Grade2 with a nanostructure exhibits mechanical properties typical for titanium alloys. The results of the research confirmed that the technology used in this work makes it possible to generate a heavy strain enough for the purpose of grain refinement.

Keywords: titanium, nanostructured materials, caliber rolling, grain refinement, mechanical properties.

1. Introduction

In recent years, numerous scientific publications concerning nanograined and ultrafinegrained metals have appeared. In this field of their production, methods classified as plastic working technologies are being intensively developed, these include: (1) severe plastic deformation (SPD) [**1-3**] and (2) certain conventional plastic working processes. All of these methods (when applied correctly) permit grain refinement and the formation of nanograined (NG) or ultrafinegrained (UFG) metals. As a result, using these methods, it is possible to significantly change the properties of the processed metal, for example, strengthening it by grain boundaries and dislocations. It should be emphasized that the advantage of these methods is that they make it possible to strengthening pure metals.

In order for a given plastic working process to be considered as an SPD method, certain requirements have to be fulfilled. It is necessary: (1) to induce a heavy strain without any change in the overall dimensions of the workpiece, (2) to refine the grains of the processed metal to a size of 100-1000nm (i.e. ultrafinegrain size) or less than 100nm (nanograin size), (3) to significantly strengthen the processed metal, and (4) to produce high-angle grain boundaries (HAGB).

Using the criteria of constant workpiece dimensions and HAGB formation, rolling methods are not SPD methods (although they do allow the production of strengthened NG and