

Accepted Manuscript

Title: Effect of process duration on the microstructures of fast multiple rotation rolling-induced nanocrystalline layer and its wear properties

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PII: S0924-0136(17)30333-3
DOI: <http://dx.doi.org/doi:10.1016/j.jmatprotec.2017.07.033>
Reference: PROTEC 15330

To appear in: *Journal of Materials Processing Technology*

Received date: 12-2-2017
Revised date: 3-6-2017
Accepted date: 29-7-2017

Please cite this article as: Wang, Yaping, Li, Yang, Sun, Kangning, Effect of process duration on the microstructures of fast multiple rotation rolling-induced nanocrystalline layer and its wear properties. *Journal of Materials Processing Technology* <http://dx.doi.org/10.1016/j.jmatprotec.2017.07.033>

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Effect of process duration on the microstructures of fast multiple rotation rolling-induced nanocrystalline layer and its wear properties

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Abstract

A nano-structured surface layer was prepared on the top surface of commercially pure titanium by fast multiple rotation rolling(FMRR) technique for the first time. X-ray diffraction (XRD), field emission scanning electron microscopy(FE-SEM), transmission electron microscopy(TEM), optical microscopy(OM), as well as Vickers test and wear test were used to characterize the microstructural evolution and mechanical properties of the nano-structured layer. The results indicated that when the treatment lasts for 60 min, the average grain size reduces to as small as 50 nm, and high-density mechanical twinning was observed in deformed grains. Moreover, the surface modification resulted in an approximately two-fold increase in microhardness of the nano-structured surface layer and

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