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PII: S0257-8972(17)30292-X
DOI: doi: 10.1016/j.surfcoat.2017.03.044
Reference: SCT 22213

To appear in: *Surface & Coatings Technology*

Received date: 21 January 2017
Revised date: 14 March 2017
Accepted date: 19 March 2017

Please cite this article as: Lihua Zhu, Yanjin Guan, Yanjie Wang, Zhendong Xie, Jun Lin, Jiqiang Zhai , Influence of process parameters of ultrasonic shot peening on surface roughness and hydrophilicity of pure titanium. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), doi: 10.1016/j.surfcoat.2017.03.044

# Influence of process parameters of ultrasonic shot peening on surface roughness and hydrophilicity of pure titanium

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**Abstract:** Ultrasonic Shot Peening (USP) can be employed to realize surface nanocrystallization and cause the changes of surface roughness and hydrophilicity at the same time, which may help improving the surface biological properties of pure titanium. In this paper, three-dimensional surface topography image, surface roughness and static contact angle of pure titanium treated by USP with different process parameters were obtained by non-contact optical surface profilometer and contact angle meter. Based on the experimental results, the influence rules and mechanism of process parameters, including peening duration, shot diameter, sonotrode amplitude and peening distance, on surface roughness and hydrophilicity of peened pure titanium were studied and the relation between surface roughness and hardness was also analyzed. After that, two relationship expressions were identified: one was between the surface roughness and surface hardness of pure titanium treated by USP while the other one was between the surface roughness and the process parameters with a correlation coefficient equal to 0.9804. According to the Wenzel model, the changes of the roughness factor r and the Young angle $\theta$ of pure titanium with different process parameters were calculated, then the influence of the surface roughness and the Young angle $\theta$ on the hydrophilicity of pure titanium were also discussed.

**Keywords**: ultrasonic shot peening, pure titanium, process parameters, surface roughness, surface hydrophilicity

## 1. Introduction

In recent years, owing to the good mechanical properties (such as high strength weight ratio, high heat proof, etc.), chemical stability and biocompatibility, titanium and its alloys are widely used in aerospace, military, marine, medicine and other many fields [1-3]. Moreover, because of different performance requirements of titanium and its alloys for various occasions, lots of surface treatments, such as plasma spraying [4], acid etching [5], sandblasting [6], high energy shot peening [7], surface mechanical attrition treatment [8], ultrasonic shot peening [9.10] and so on, were applied for surface modification or strengthening to better suit some specific situations.