Accepted Manuscript

Study of the wettability behavior of stainless steel surfaces after ultrafast laser texturing

C. Sciancalepore, L. Gemini, L. Romoli, F. Bondioli

PII: S0257-8972(18)30851-X
DOI: doi:10.1016/j.surfcoat.2018.08.030
Reference: SCT 23696

To appear in: *Surface & Coatings Technology*

Received date: 13 April 2018
Revised date: 16 July 2018
Accepted date: 9 August 2018

Please cite this article as: C. Sciancalepore, L. Gemini, L. Romoli, F. Bondioli , Study of the wettability behavior of stainless steel surfaces after ultrafast laser texturing. Sct (2018), doi:10.1016/j.surfcoat.2018.08.030

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Study of the wettability behavior of stainless steel surfaces after ultrafast laser texturing

C. Sciancalepore[1], L. Gemini[2], L. Romoli[3], F. Bondioli[1,3]

[1]INSTM, Research Unit of Parma, Department of Industrial Engineering, University of Parma, Parco Area delle Scienze 181/A, 43124 Parma, Italy
[2]ALPhANOV, Institut d'Optique d'Aquitaine, Rue François Mitterand, 33400 Talence, France
[3]Department of Engineering and Architecture, University of Parma, Parco Area delle Scienze 181/A, 43124 Parma, Italy

Abstract

The interest in superhydrophobic surfaces has grown exponentially over recent decades. Since the lotus leaf dual hierarchical structure was discovered, researchers have investigated the foundations of this behavior and many methods have been developed to obtain superhydrophobic surfaces. In this paper the possibility to use ultrafast laser treatments to obtain hydrophobic and superhydrophobic stainless surfaces was investigated on a AISI 316L stainless steel, ranging the total energy doses provided to the surfaces from 178 to 1143 J/cm^2. As SEM-FEG images reveals, different surface microstructures can be obtained at the increasing values of energy dose.
Independently on the specific values of laser treatment, all the obtained samples showed hydrophobic values of static contact angle. However, only particular surface microstructures allowed to obtain a self-cleaning surface characterized by low values of both contact angle hysteresis and roll-off angle.
The obtained results led to define the effect of the laser parameters on the morphological, chemical and wetting surface properties allowing to design new textures with the desired wetting properties, from "lotus effect" surfaces to "rose petal effect" surfaces.

Key words: superhydrophobicity; laser; biomimetic surface.

1 Introduction

The wettability of rough surfaces is a complex problem which continues to attract interest, thanks to new technologies and materials that allow to obtain surfaces with controlled micro- and nano-roughness[1]. Starting from the work of Neinhuis and Barthlott [2] that explained the origin of the superhydrophobicity and self-cleaning properties of the lotus leaf (the so-called "lotus effect"), a lot of efforts have been devoted to reproduce the micro and nano features of such surface, characterized by a water contact angle higher than 150° and, in general, low surface energy. Several techniques already exists to produce large-area superhydrophobic surfaces: transparent coatings have been developed for different kinds of window, as automobile windows [3], and eyeglasses, or to increase the performance of solar cells [4], to control bio-adhesion [5][6][7] and bio-fouling [8][9][10]. Nevertheless, most of these techniques, as for instance chemical vapor deposition (CVD) [11][12], electro-chemical deposition [13], and sol-gel method [14], involve the use of chemical coatings and show several drawbacks, especially in applications in which the release of coating particles into the environment is extremely critical. As an example, in food industry it is strategic that the coating used for tools undergoing chemical attack, scratches or wear, do not contaminate the products, which they contribute to cut, convey or package.
In this work, the possibility to use chemical-free ultrafast laser treatment to obtain hydrophobic and superhydrophobic stainless steel surfaces was investigated on AISI 316L, generally employed as food contact material. This technique offers several advantages over the other previously mentioned. Laser texturing is a one-step contactless approach that can be exploited with a flexible

Download English Version:

https://daneshyari.com/en/article/8023216

Download Persian Version:

https://daneshyari.com/article/8023216

Daneshyari.com