Fabrication of superhydrophobic on Ti6Al4V by using the hybrid process of nanosecond laser texturing

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Abstract. This study aims to investigate the effect of laser parameters on the development of superhydrophobic surfaces by using nanosecond laser texturing with a chemical coating. Ti6Al4V specimens were ultrasonically cleaned before applying silicone oil and laser textured onto the material surface. Nanosecond laser texturing is executed in an argon environment by varying several parameters, such as laser power, laser scan speed, and hatching distance. After that, the textured specimen was again ultrasonically in an acetone bath to clean the surface. Superhydrophobic surfaces are determined by measuring the water contact angle using the sessile drop test method, while the surface profile of the laser textured surface was studied by using a 3D laser scanning confocal microscope. It is found that the use of the laser power above 25W can produce surfaces with a water contact angle of more than 150° while increasing the laser scanning speed from 50 to 500 mm/s will cause the water contact angle to decrease by 16%.

Keywords: superhydrophobic; Ti6Al4V; nanosecond laser; laser texturing; water contact angle.

1 Introduction

Surface characteristics and irregularities associated with a particular pattern, size, shape, density, and arrangement are referred to as micro/nano-texture. Any surface with a micro/nano-texture has functional variation. Hydrophobicity is one of the most significant functions of surface roughness [1]. The hydrophobic surface is determined by the water contact angle (WCA). In general, the hydrophobic surfaces are indicated by a WCA that is larger than 90°, while the WCA higher than 150° is called a superhydrophobic surface (SHS) [2]. Application of hydrophobic surface has gotten more attention in many research with the wide area coverage including aeronautics, marine, and shipyard, medical, industrial, and agriculture production [1, 3]. SHS has gotten a lot of attention because of its potential application, such as self-cleaning from water repellency [4], anti-corrosion [5], antibacterial adhesion [6], and drag reduction [7].