Transition of Laser Patterned Ultrahydrophilic Surface to Ultrahydrophobic by Vacuum Process

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Inspired by the "lotus effect" superhydrophobic surfaces have been fabricated by ultrafast laser sources with dual scale microstructures, which exhibits self-cleaning characteristics and bouncing of water droplets with low sliding angles. Aluminum alloy 7075 is commonly used engineering material in industries, especially in aerospace and defense industry for its superior physical, chemical and mechanical properties. However, the wetting properties are not appreciable despite the high demand for superhydrophobicity, which could result in anti-ice and self-cleaning surface behavior. Laser direct writing is high efficient technique to fabricate dual scale micro/nano-structures on plethora of material surfaces with precise control over the geometrical dimensions of the micro features. In the present study, the wetting properties of aluminum 7075 alloy has been modified by picosecond laser source and post high vacuum process to accelerate the aging process. Aluminum samples of thickness of 5 mm were laser machined with infrared laser pulses of 1.8 picoseconds with different process parameters to optimize the surface geometry and wetting properties. The laser patterned dual scale (microand nano) microstructures exhibited superhydrophobic/ultrahydrophobic character with a maximum contact angle of 180° for the droplet volumes in the range 4-20μL. Moreover, the transformation from ultrahydrophobic to superhydrophobic was observed for the bigger droplet volumes.