Associazione Italiana delle Tecnologie Manifatturiere

PREMIO DI LAUREA "F. SOAVI" 2024

Scheda sintetica tesi

Titolo: Femtosecond laser texturing of SS321 and Al5251: effect of process parameters on surface properties

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Università di appartenenza: Università di Genova, Dublin City University

Abstract del lavoro di tesi (massimo 1000 caratteri): This work, carried out at Dublin City University (IRL) explored the surface texturing of two distinct materials, SS321 and Al5251, through femtosecond laser processing. Employing the Design of Experiment approach, a systematic investigation was conducted to understand the influence of process key parameters, including laser power, scan speed, hatch distance, and pattern angle on the surface characteristics. The primary objective was to assess the resulting changes in wettability, with a focus on achieving hydrophilicity and, notably, superhydrophilicity.
Once optimized laser texturing, an extensive experimental campaign was conducted, including profilometry to quantify surface roughness, scanning electron microscopy for microstructural analysis, and spectrometry to delve into optical properties of the surfaces. Compelling results were found, demonstrating super hydrophilic behavior for selected samples. The optimum outcomes were achieved with water contact angles of 3° for SS321 and 4° for Al5251.
The obtained super hydrophilic surfaces hold significant promise for applications in various industries, including enhanced fluid dynamics, anti-fogging coatings, and improved adhesion. This research contributes valuable insights into the controlled femtosecond laser surface texturing of different materials and offers a comprehensive understanding of the resulting wettability changes, paving the way for practical advancements in surface engineering.

Immagini illustrative (massimo 3):

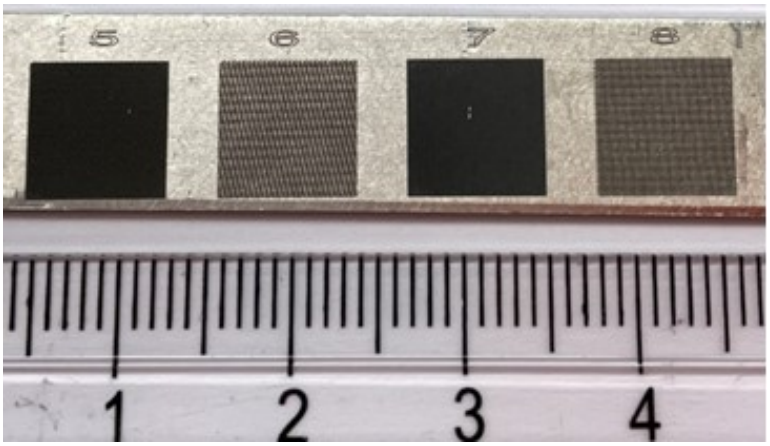

Fig 1 – Picture of four produced textures on one SS321 sample

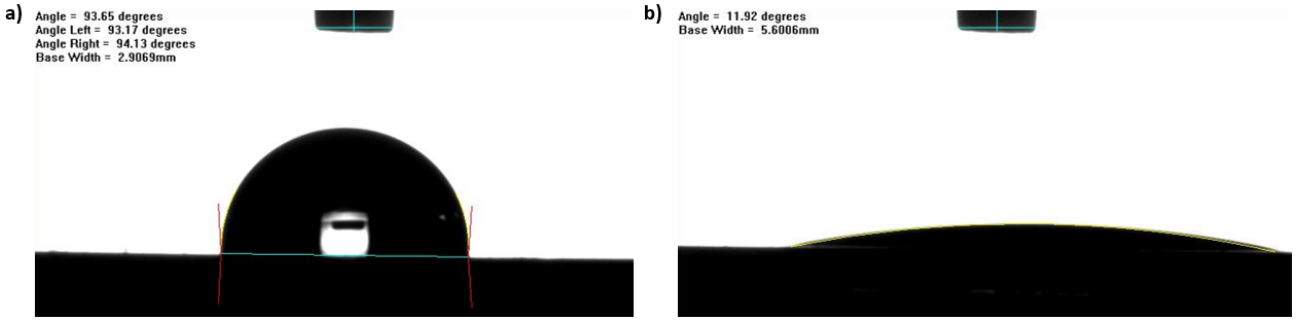

Fig 2 – Water Contact Angle (WCA) image for (a) SS-Untextured (WCA=93.6°) and (b) SS-1 (WCA=11.8°)

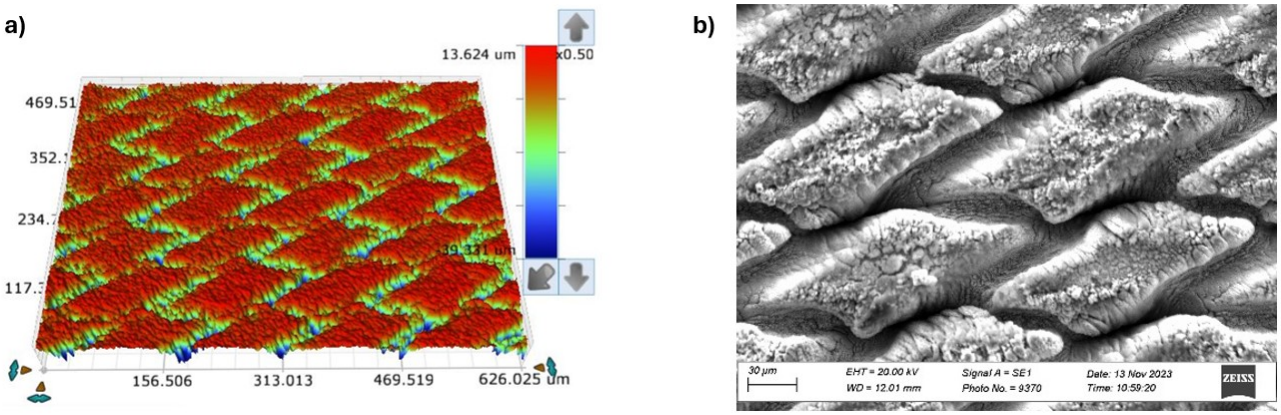

Fig 3 – (a) Profilometer image and (b) Scanning Electron Microscope (SEM) image of one sample