DEVELOPMENT OF MODIFIED WETABILITY SURFACES ON METALLIC SUBSTRATES BY SHORT PULSE LASER MICROSTRUCTURING

R. Jagdheesh, J.J. García-Ballesteros, A. Tur, J.L. Ocaña(*)
UPM Laser Centre. Universidad Politécnica de Madrid. Ctra. Valencia, k. 7.3. 28031 Madrid. Spain
(*)Email: jlocana@etsii.upm.es

ABSTRACT
The generation of hydrophobic surfaces has gained considerable interest due to the potential applications in industry such as microfluidics, lab on chip devices and coating for automotive, aerospace vehicles and home appliances. Ultra short laser machining/structuring is a promising technique to obtain the dual scale roughness on the metal surface which promotes the complex interfaces between solid-liquid-air, thus improving the wetting property of the surface.

Keywords: Laser microstructuring, short pulse lasers, surface functionalization, superhydrophobicity.

INTRODUCTION
The recent studies on laser micromachining have demonstrated their ability for fabricating micron/nano scale features with very limited distortion to peripheral area [1-2]. Material is removed from a substrate by ablating the surface, using one or more laser pulses. The ablation process, and thus the micron scale features created, depends on the laser properties such as laser pulse width, energy of the pulse, repetition rate and the material used. The superhydrophobic effect has been observed by Jagdheesh et al on metals by adopting two step process [3] and on ceramics by single step laser process [4].

Although, laser pulses in nanosecond regime can produce defects in micromachining like relatively large heat-affected zones, dross and recast, these laser sources are widely preferred in industry due to large pulse energies and high pulse repetition rates, what provides accelerated machining process. The nanosecond laser processed structure/pattern of metals at ultra violet (UV) wavelength is one of the less explored aspect with respect to improvement on the wetting property.

RESULTS AND CONCLUSIONS
In this study, a variable repetition rate nanosecond laser pulses were applied on flat substrates of aluminum (Al) to fabricate blind microholes. Micromachining experiments were performed with different laser parameters with respect to the static contact angle measurement (CSA). The resulting structures were analyzed with scanning electron microscope (SEM) and confocal laser scanning microscope (CLSM) to evaluate the geometrical parameters of the structures. The chemical changes on the machined surface were analyzed with Energy-dispersive X-ray spectroscopy. An attempt was made to study the improvement of wetting properties of aluminum by nanosecond laser source in one step process. Flat aluminum sheets
of thickness 100 µm were laser machined with ultraviolet laser pulses of 30 ns with different laser parameters to optimize the process parameters. The samples produced at the optimum conditions with respect to contact angle measurement were subjected to microstructure and chemical analysis. The wetting properties were evaluated by static contact angle measurements on the laser patterned surface. The laser patterned surface has micropillars (fig.1) and micro cell structure on the top of the micropillars, which can trap air inside the grooves as well as in the microcell structure and gives composite interface of air-liquid-solid upon aluminum surface. The laser patterned micropillars exhibited Superhydrophobicity with a maximum contact angle of 160°.

![Fig. 1 - Microscopic view of laser processed micropillars](image)

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**REFERENCES**


