Impact of laser texturing parameters and processing environment in the anti-wetting transition of nanosecond laser generated textures in stainless steel.

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Super-hydrophobic surfaces have been a subject of significant interest in the engineering field for many years, particularly due to the potential to create self-cleaning surfaces. A droplet of water landing on a super-hydrophobic surface will roll or slide away, whilst taking with it any surface debris. Superhydrophobic surfaces found in nature indicate that hierarchical structures with roughness or features at two length scales have good anti-wetting performance; a task for which a short pulsed laser is ideally suited.

In this presentation we report our work in which flat sheets of SS304S15 were textured using a nanosecond pulsed fibre laser operating at 1064 nm wavelength. Quantitative analysis of the wettability of the laser structured surfaces was carried out by measuring the static contact angle of a droplet of deionized water with a volume in the microliter range. As with other reports, these surfaces are initially hydrophilic, and after a time delay of some days to weeks transition into hydrophobic, and in some cases super-hydrophobic. There have been many reports on laser generated superhydrophobic surfaces and methods in which this transition can be accelerated after the substrates have been processed, however very little investigation into effect of processing environment in laser texturing process has been published. Shielding gases such as argon are used in other laser processing technologies to modify the laser material interaction between the laser and the substrate which is the core research topic for this paper. Our results show that processing under an argon atmosphere changes the appearance of the surface to the naked eye, reduces the overall removal of material and shortens the anti-wetting transition when compared to laser texturing under normal atmospheric conditions.