

Laser microstructuring polymeric surfaces

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Abstract – This study presents a methodology to obtain microstructured polymeric surfaces that can be used as water-repellent surfaces. This methodology employs Surface Relief Grating inscription in polymeric films containing azodyes using a laser beams interference pattern.

In the last decade, polymeric materials have been developed to meet the increasing mechanical, thermal, electrical and optical properties required for applications. Numerous techniques were proposed for machining and structuring polymers, including laser microstructuring methods²⁻⁴. Here, we present a simple structuring process that uses continuous wave laser excitation to create microstructured surfaces⁵ with potential applications to fabricate superhydrophobic polymeric surfaces. The wettability of a surface depends on its chemical nature and topology¹. Motivated by the topology of the lotus leaf, researchers created methods for roughening (microstructuring) surfaces in order to achieve superhydrophobicity. In this study, we used the large scale molecular migration, obtained when azopolymeric films are exposed to an intensity gradient laser pattern, to perform the microstructuring of the surface³⁻⁵. The surface relief obtained is formed due to the photoinduced *trans-cis-trans* isomerization of the azo chromophores, in which the interaction of molecular dipoles with the electric field gradient of the laser light results in the wormlike physical movement of the molecule. The microstructures were fabricated using a p-polarized Ar⁺ laser operating at 488 nm and 140 mW/cm² for about 100 minutes³⁻⁵. Figure 1 shows an Atomic Force Microscopy (AFM) image of the polymer film surface, where a periodic pattern of approximately 1.5 μm can be observed.

A horizontal microscope equipped with a goniometer was used for measuring the static contact angle of a water droplet to determine wettability of surfaces studied. Our initial results revealed an increase of $\sim 10^\circ$ in the contact angle for water in the microstructured surface. Although further work is still needed to improve the surface microstructure that leads to an enhanced hydrophobicity, our results show that the method presented is a good candidate for such kind of applications.

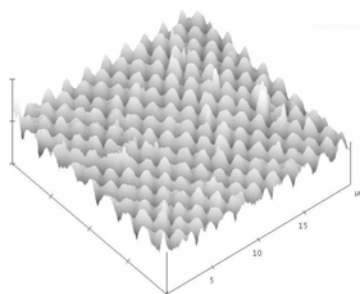


Fig. 1. AFM image of microstructured surface.

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