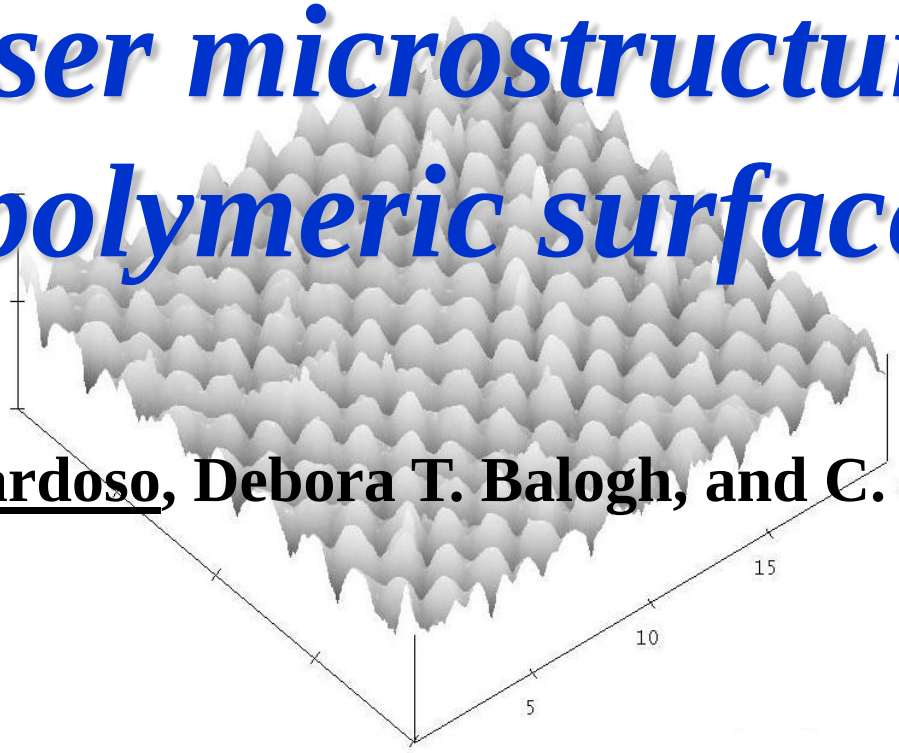
Laser microstructuring polymeric surfaces



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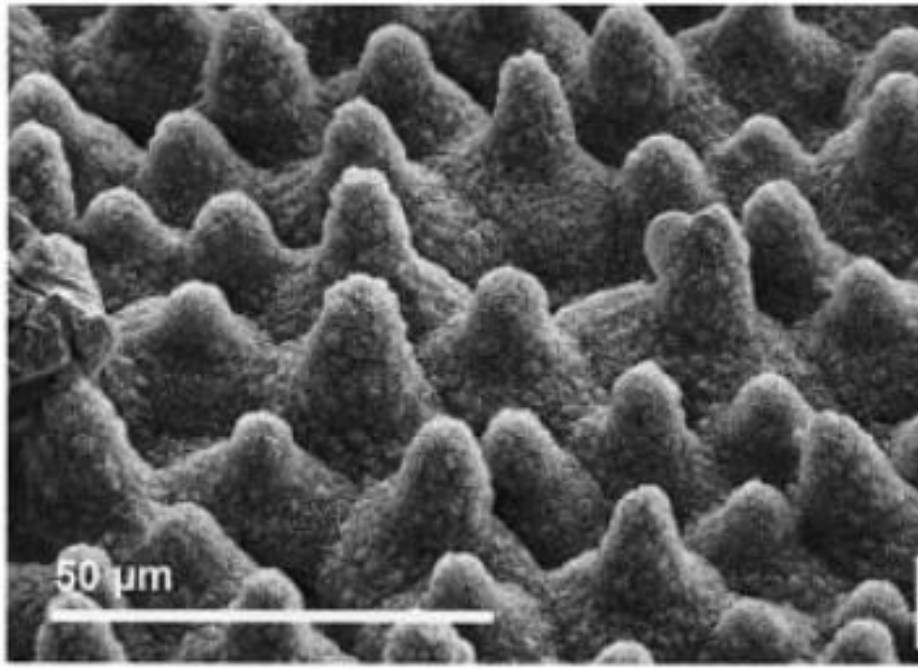
Purpose

We present a simple structuring process that uses cw laser to microstructuring surfaces, with potential applications to fabricate superhydrophobic polymeric surfaces.

Motivation

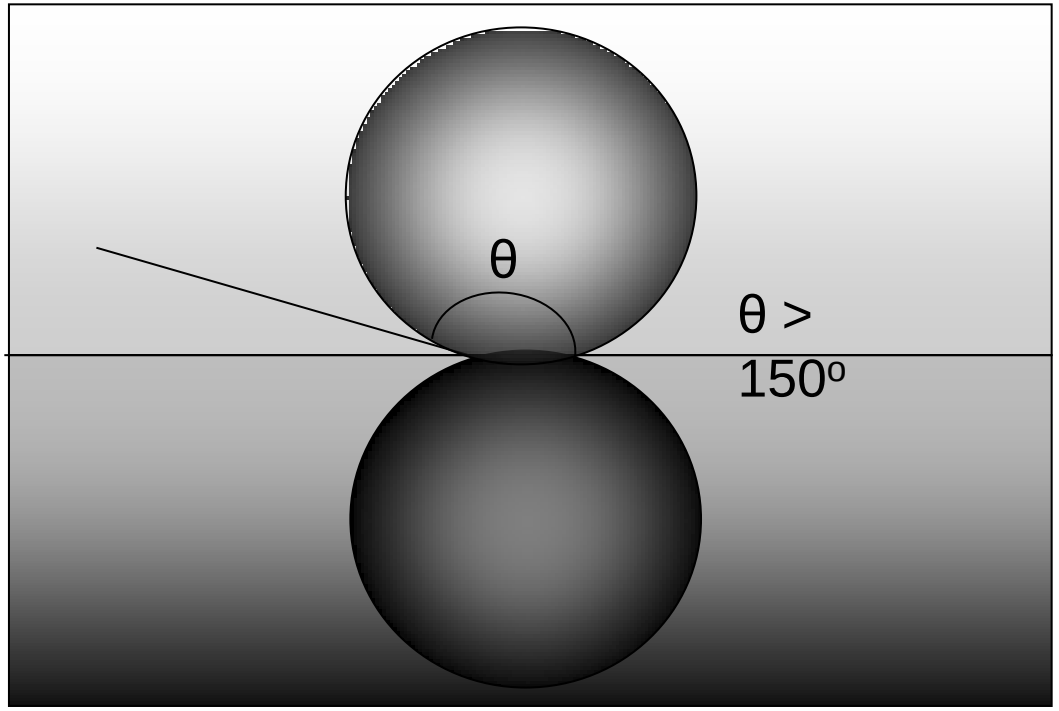
Nelumbo Nucifera



Micromorphological characteristics of water-repellent leaf surfaces.

Inspired by the topology of the Lotus leaf, that naturally have a superhydrophobic surface, we used laser light to structuring polymeric surfaces.

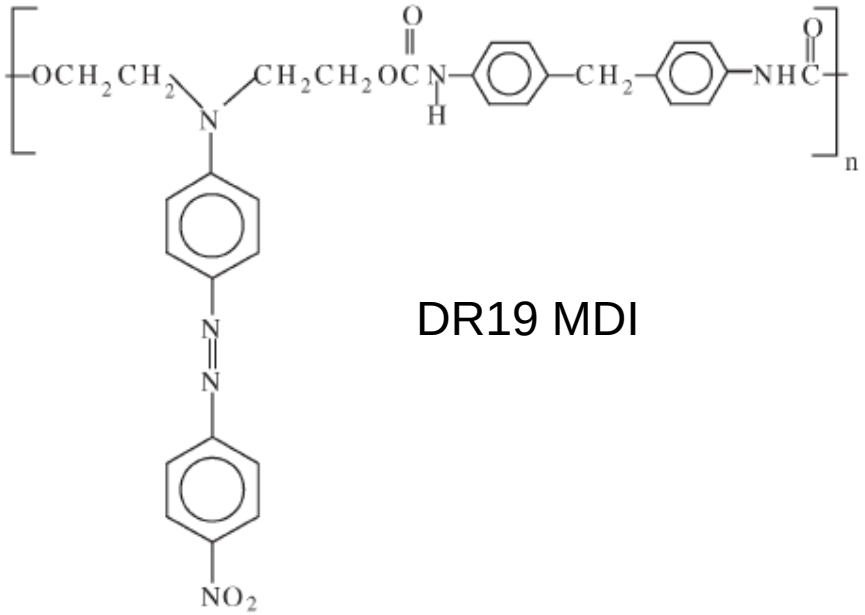
Introduction



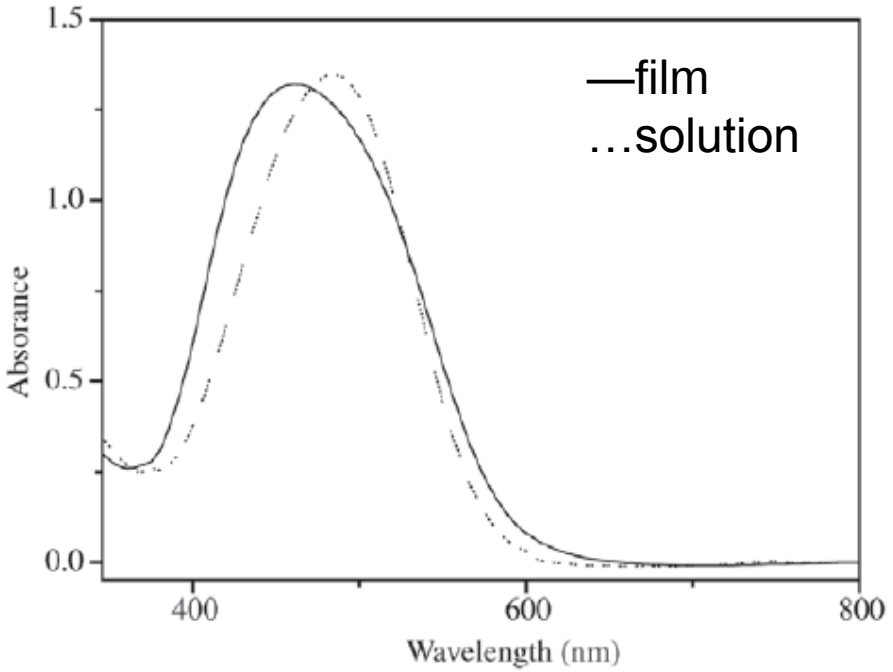
Superhydrophobics surfaces exhibit contact angles with water that are larger than 150º and insignificant hysteresis. This effect, so called Lotus effect, decreases the contact area between the surface and water, reducing contamination and abrasion.

Introduction

We used the surface relief grating mechanism present in azopolymers to perform the microstructuring of the polymeric surface.

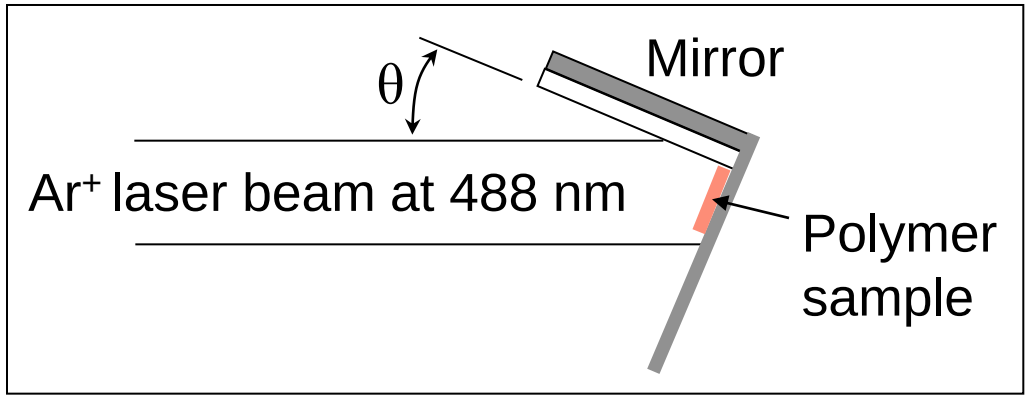


DR19 MDI



UV-Vis Spectra DR19 MDI film and solution

Methodology

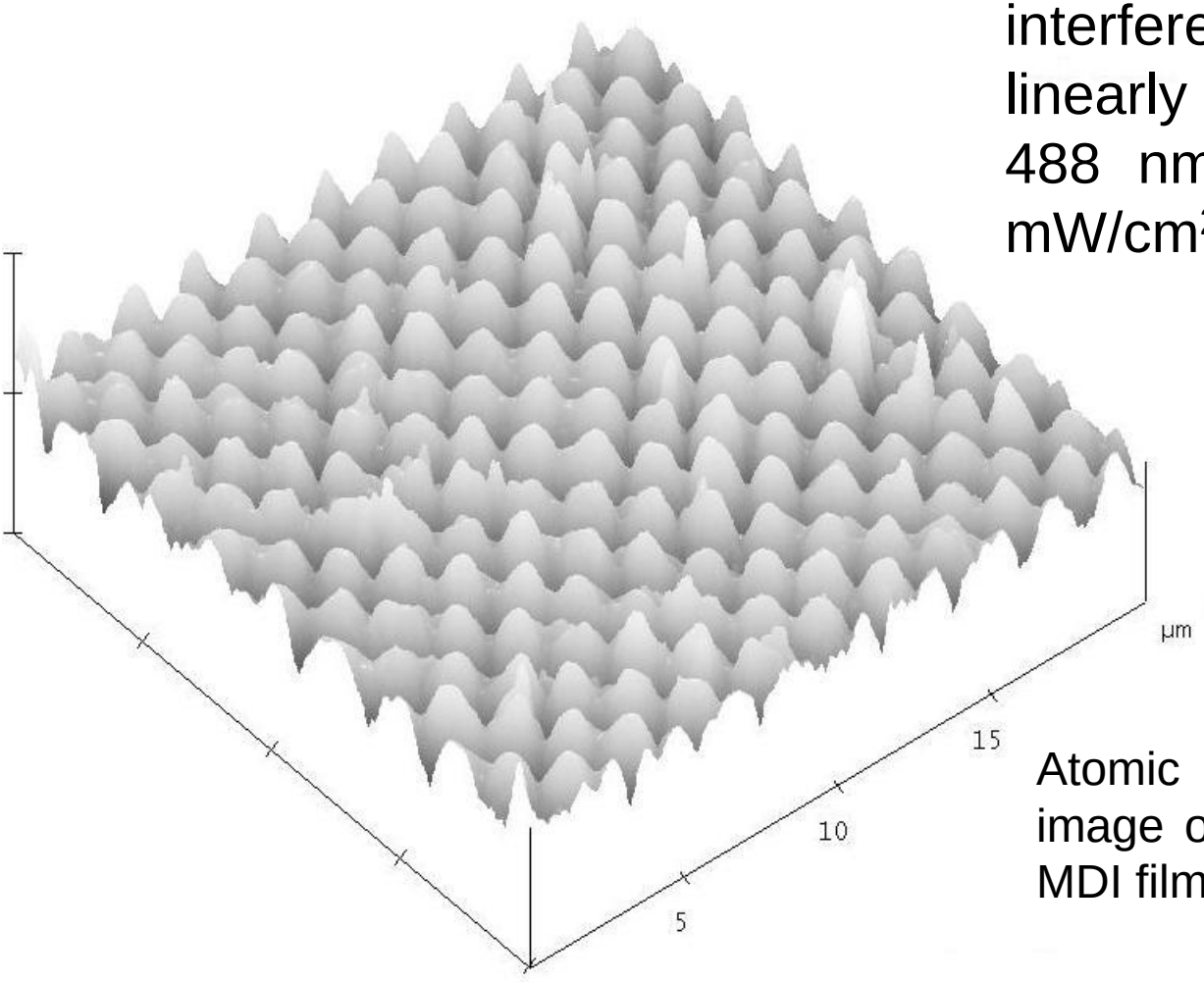


Surface-relief gratings (SRG) are formed when a film of azopolymer is exposed to an laser beam interference pattern, as a result of large scale molecular migration.

Such gratings are formed due to the interaction of the molecule dipole with the electric field gradient, which results in the movement of the molecule. Besides, the photoinduced *trans-cis-trans* isomerization of the azo chromophores facilitates this movement.

Results

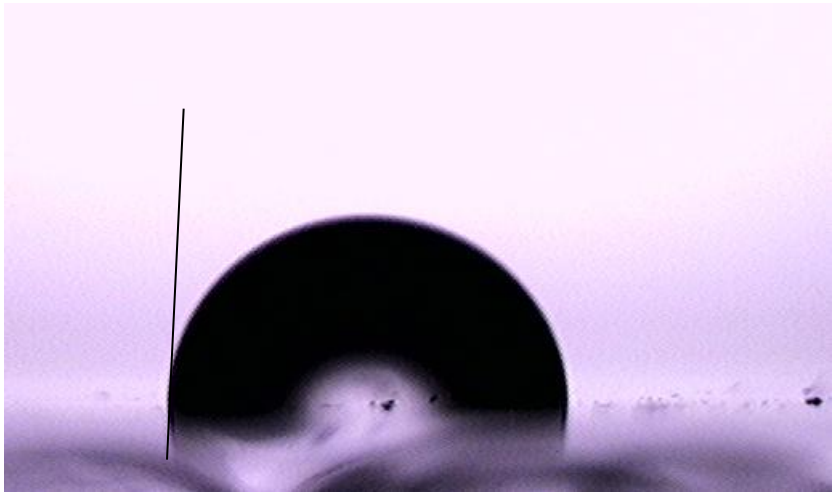
The film was exposed to an interference pattern generated by a linearly p-polarized Argon ion laser at 488 nm, with an irradiance of 350 mW/cm^2 for 20 min.

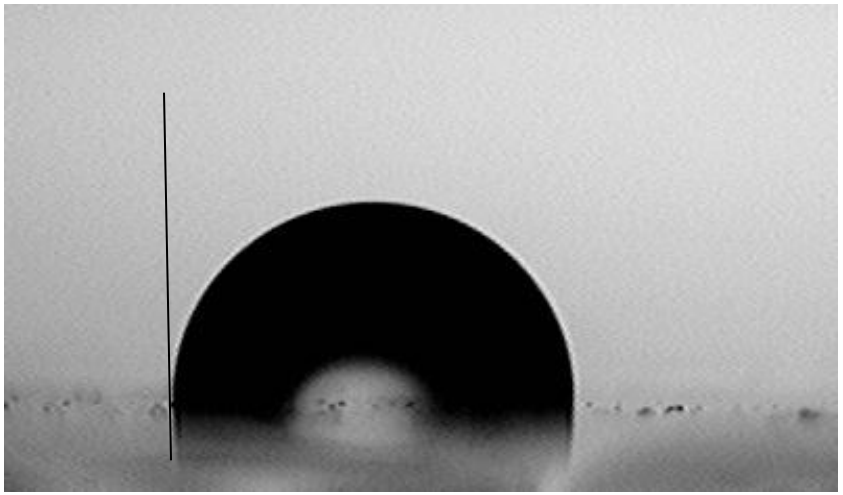


Atomic force microscopy: 3-D topography image of the surface relief gratings on the MDI film.

Results

The static contact angle on the flat surface is 85.5^0. In the microstructured surface the contact angle is 90.7^0, an increase of 5%.





Photographs of water droplets on flat (left) and microstructured (right) polymeric surfaces obtained by a horizontal microscope equipped with a goniometer.

Conclusion

We showed that it is possible to increase the hydrophobicity of polymeric surfaces by laser microstructuring.

Our initial results revealed an increase of 5% in the contact angle for water in the microstructured surface.

The results show that the method presented is a good candidate for microstructuring azopolymeric surfaces for this application.

Further work is still needed to improve the surface microstructure, which can lead to a better enhancement in the hydrophobicity.

Acknowledgements

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