Pattern formation of photoactivated functional polymers

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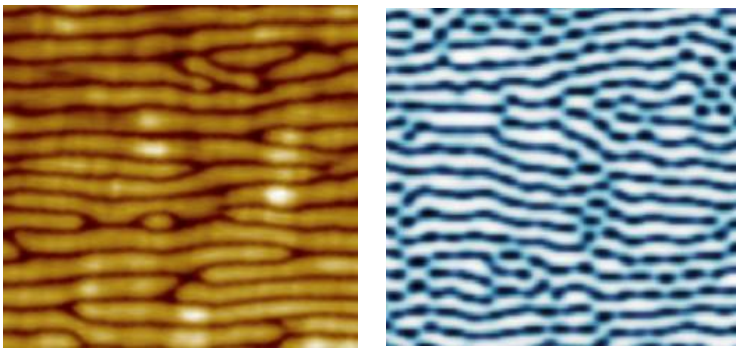
In 1952 the famous mathematician and computer science pioneer Alan Turing published his visionary work *The Chemical Basis of Morphogenesis*. In his work Turing developed an intuitive model explaining the formation of complex patterns found in nature, as for example the striped coat of a tiger.
Recently we showed that the complex patterns formed on the surface of azobenzene-containing polymers films can be understood in the spirit of Turing's work.
Azobenzene-containing polymers are special. They are *smart* polymers that alter their shape and properties when illuminated by light of suitable wavelengths. Under illumination, the polymer surface spontaneously reorganizes its morphology according to the light intensity and polarization state. The peculiar azopolymer sensitivity to illuminating light may have important application prospects in the area of optical nanolithography where photoresists are used in the fabrication process.



Atomic Force microscopy image of the reorganized polymer morphology (left) and simulation (right) after exposure to light

According to our new work [1], the role of light in photo-patterning of azo-polymers is of triggering the instability by creating two phases in the polymer, called *cis*- form and *trans*-form. Although these two forms are two configurations of the same molecule, they are quite different in terms of their chemical/physical properties. So, similarly to oil in water, these two phases do not mix and try to separate. This simple picture accounts for all the patterning found so far and actually adds new comprehension of the response of this important class of polymers to external light stimuli

[1] H. Galinski, A. Ambrosio, P. Maddalena, I. Schenker, R. Spolenak, and F. Capasso, Instability-induced pattern formation of photoactivated functional polymers**,** *PNAS* vol. 111, p. 17017 (2014)