Morphing Surfaces in Ordered Polymer Networks

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Introduction

We are aiming to develop morphing surfaces in liquid crystal polymer networks (LCNs). LCNs undergo dimensional changes when order parameter decreases. When confined on a rigid substrate, this manifests as a bulging surface deformation, see Fig. 1.

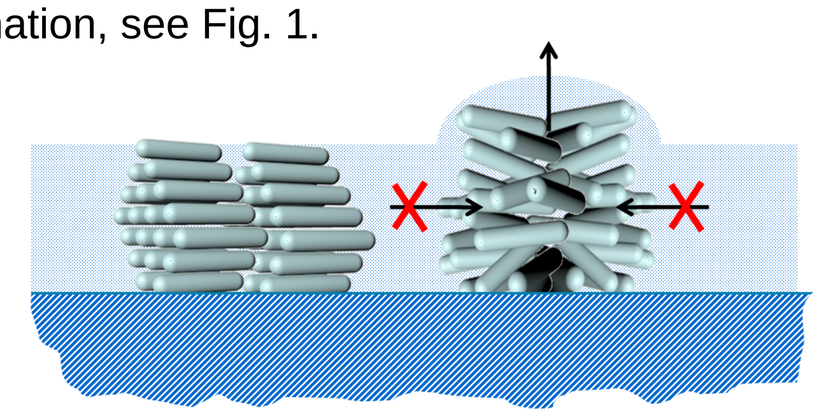

Fig. 1. Schematic representation of the formation of protrusions in LCNs coatings.

Results and Discussions

Some examples are given. Azobenzene monomer is co-polymerized with the LCNs to induce photomechanical effects. When illuminated with UV light, the *cis* isomer reduces molecular order of the LCNs and initiates the formation of surface topographies

Dynamic gratings

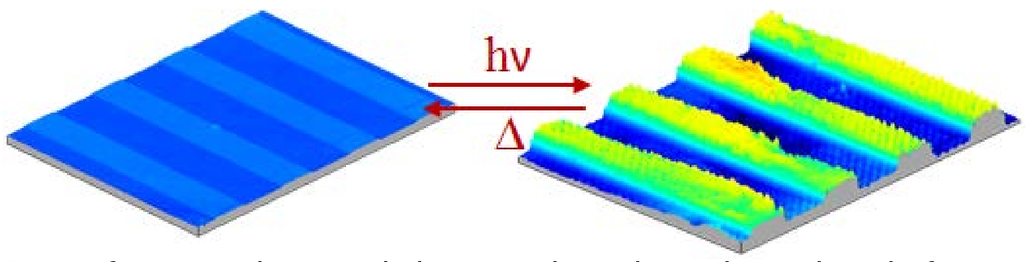

Fig.2. Interference microscopic images show dynamic gratings before and during deformation.

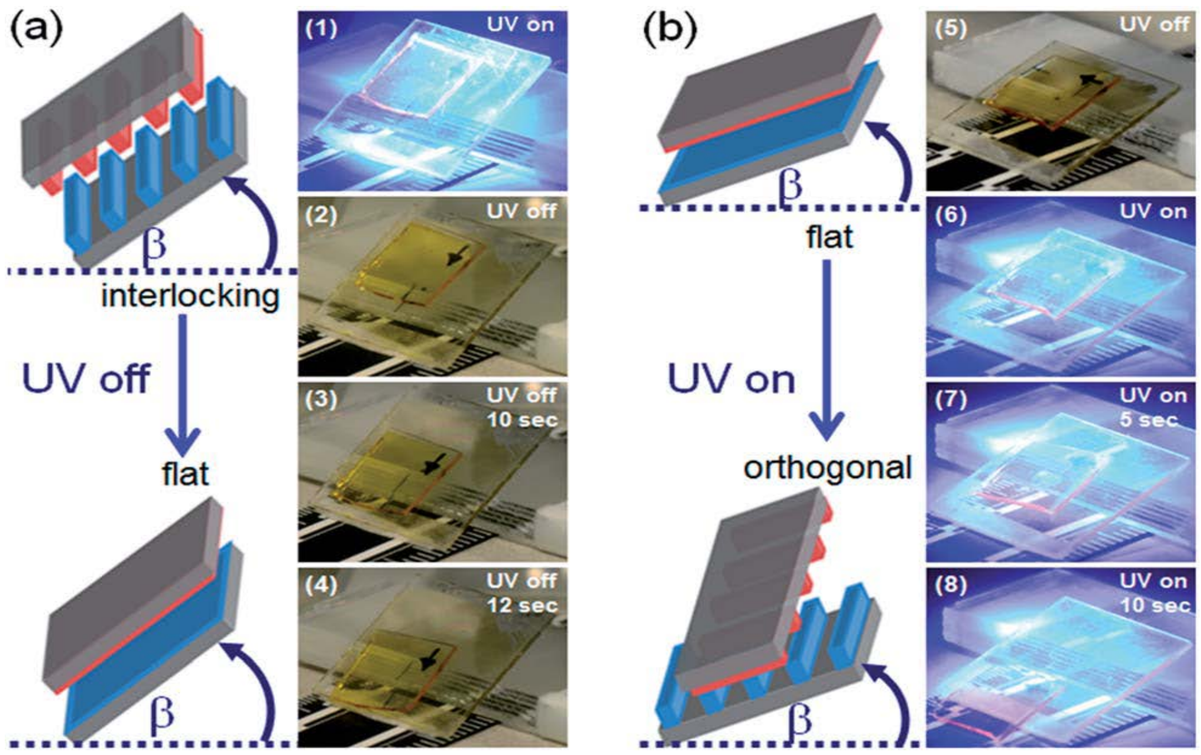

Fig. 3. Snap shots of glass plates sliding when the static friction changes (a–d) from an interlocking to a flat state and (e and f) from a flat to a state with orthogonal alignment.

Dynamic Poly-domain LCNs

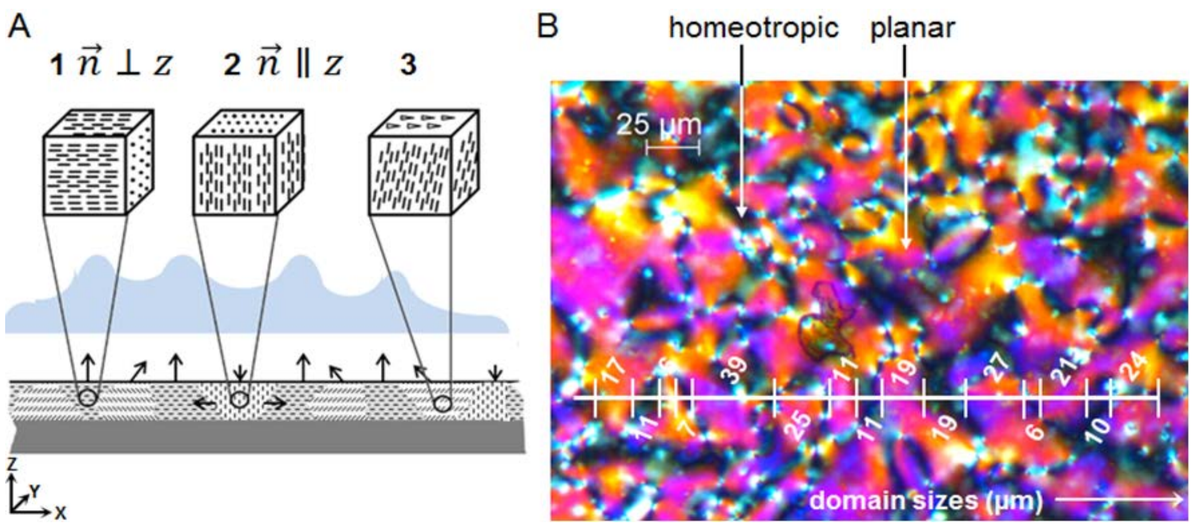

Fig 4. (A) Schematic representation of the predicted deformation of the polydomain liquid crystal. (B) Polarized optical microscopy images of a polydomain texture as observed between crossed polarizers.

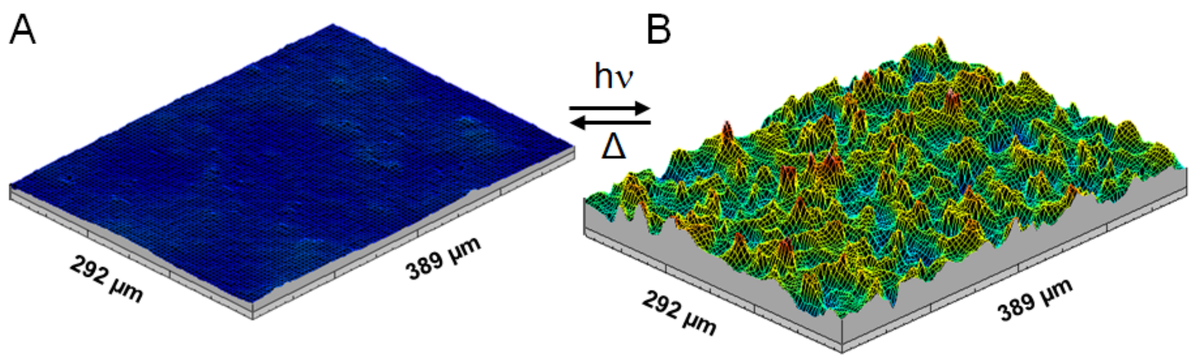

Fig 5. Interference microscope images of polydomain liquid crystal polymer surfaces. (A) 3D image of the initial flat state, (B) 3D image of the UV activated surface topographies.

Dynamic Fingerprints

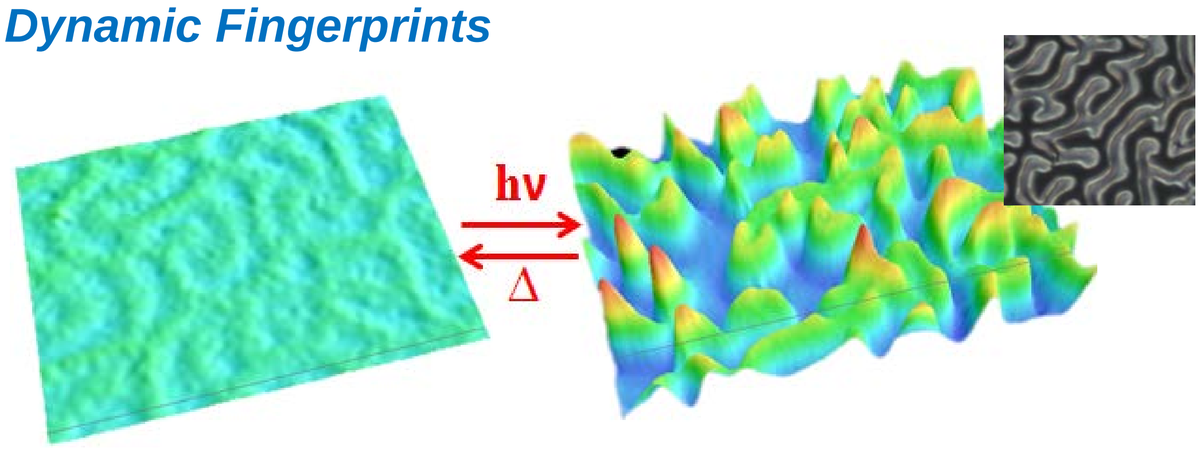

Fig 6. Confocal microscopic images of fingerprints. (left) 3D image of the initial flat state and (right)3D image of surface topographies under UV exposure. Insert is the polarized optical microscopy image of a fingerprint texture

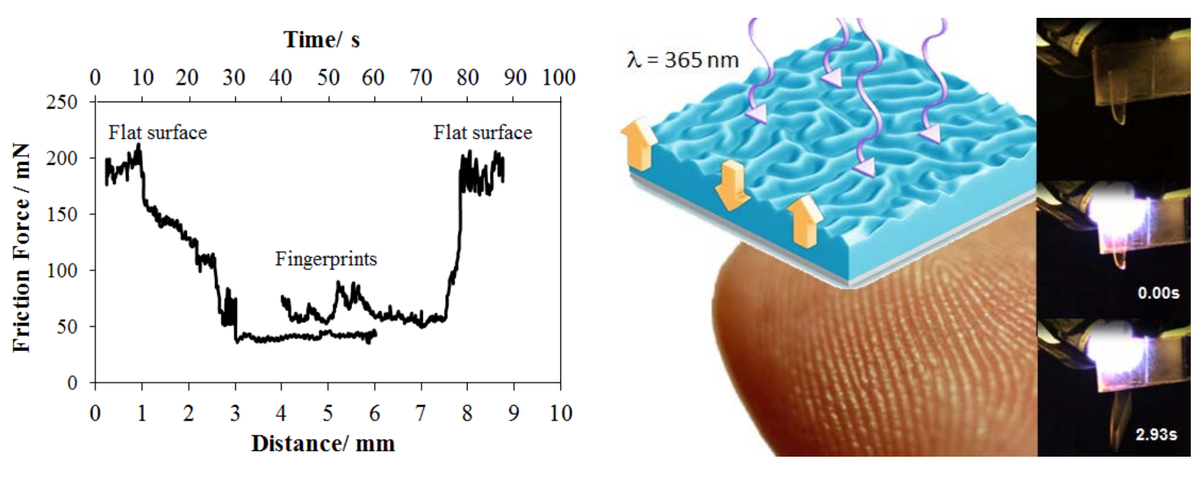

Fig. 7. (left) Dynamic friction force traces when switching the fingerprints between 'on' and 'off'. (right) A gripper that releases an object upon UV illumination.