Surface pattern based on an azobenzene-containing copolymer thin film and its light-driven morphology modulation

偶氮苯基共聚物薄膜的表面形貌及其光诱导调节

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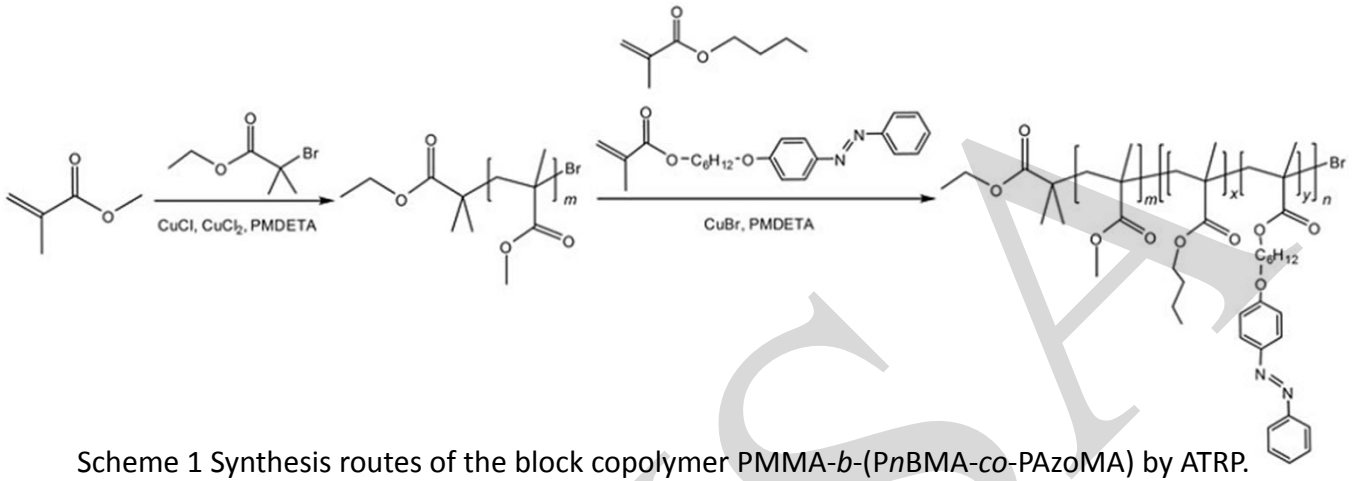
- Lowering the glass-transition temperature of the host polymer matrix will improve isomerizing speeds of azobenzene in the polymer. But it will also compromise other physical properties such as hardness.

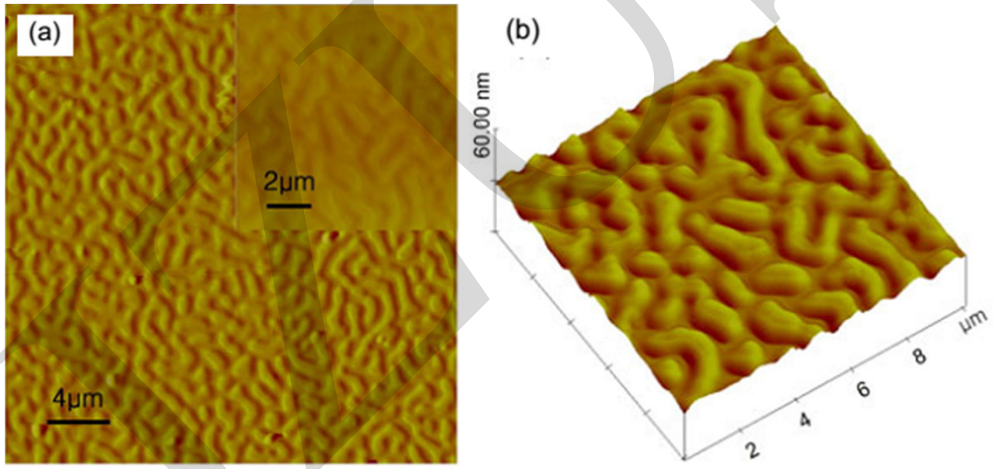
- A kind of azobenzene-containing block copolymer consisting of hard block PMMA and soft block (PBMA-*co*-PAzoMA) is synthesized by atom transfer radical polymerization. The azobenzene units are confined in the soft PBMA chemical surroundings due to microphase separation between PMMA and PBMA segment. This microphase separated structure will improve the isomerization of azobenzene in the polymer matrix without sacrificing the polymer hardness.

- The annealed thin films of the block copolymer show featured surface morphologies consisting of bicontinuous strip or island-shaped structures depending on the film thickness. These surface morphologies of these films are induced by dewetting process.

- The surface pattern on the film can be modulated reversibly between strip or island-shaped structures by controlling the photoisomerization of azobenzene in the polymer at room temperature.



Scheme 1 Synthesis routes of the block copolymer PMMA-*b*-(P*n*BMA-*co*-PAzoMA) by ATRP.



The annealed copolymer thin film with thickness 48.8nm shows coexisting strip and island shaped structures.

Fig. 1 AFM phase image (a) and corresponding 3D image (b) of the annealed copolymer thin film coated on the silicon wafer. The film thickness is 48.8 nm.

The thin film shows morphology changing from long-strip to short-strip and island shaped structures with decreasing the film thickness.

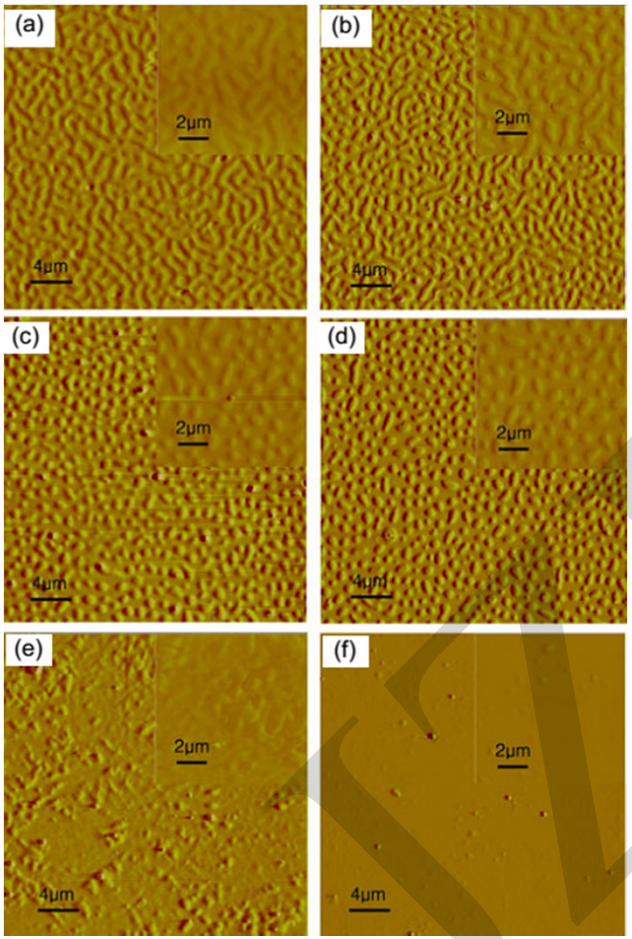


Fig. 2 AFM phase images of the copolymer film with different thicknesses of 48.8 nm (a), 45.1 nm (b), 36.2 nm (c), 31.7 nm (d), 29.3 nm (e), and 28.0 nm (f).

The bicontinuous strip structures on the film can convert reversibly to the island-shaped structures by controlling the photoisomerization of azobenzene in the polymer at room temperature.

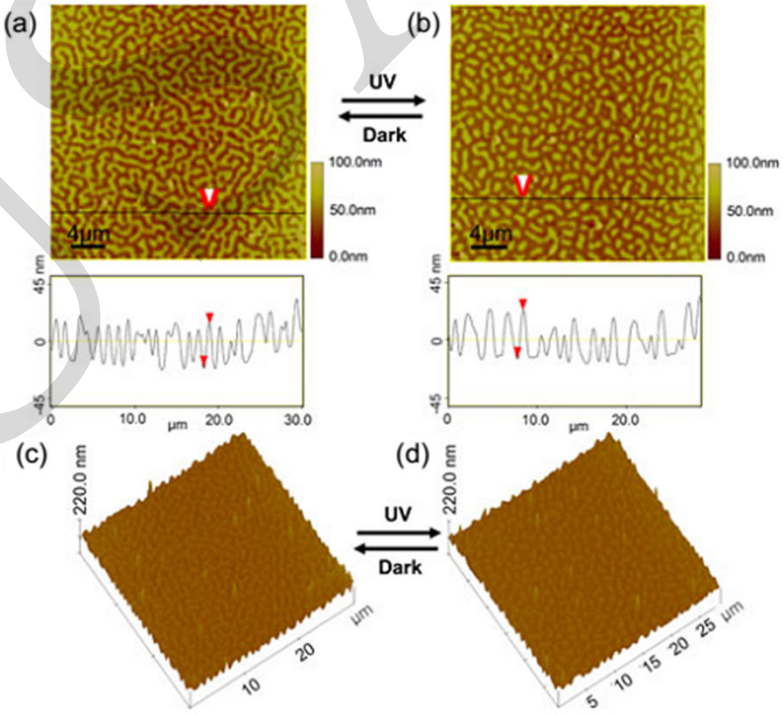


Fig. 3 AFM height images (a, b) and corresponding 3D images (c, d) of copolymer film before and after UV light irradiation for 3 min. The film thickness is 48.8 nm.