

Localized Wrinkling of Thin Films on Shape Memory Polymer Substrate

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Shape memory polymers (SMPs) can remember different shapes and can recover to their permanent shapes from temporary shapes with appropriate stimuli, such as heat, humidity, and electrical field. Using pre-programmed heat responsive SMP as substrate, we demonstrate a self-assembly fabrication method for programmable localized surface wrinkling. Different from global wrinkling in most of the literature, locally heating the thin film-substrate system causes localized recovery in the SMP substrate and thus induces localized thin film wrinkling. The wrinkle pattern shows good sinusoidal profile, with wavelength and amplitude decreasing gradually with the distance from the heating source. The surface wrinkle area can also be tuned by controlling heat input. In addition, the spectrum test was also performed, which shows peak shift of the spectrum with location due to wavelength change. This study can offer a simple and programmable method to fabricate localized wrinkling pattern, with potential applications in programmable optical gratings, surface property control, and other demanding applications.