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Self-folding of Polymer Sheets Responding to Light: Applications and Mechanistic Study YING LIU, MICHAEL DICKEY, JAN GENZER, North Carolina State University — We describe a simple approach to self-folding that uses localized light absorption on a pre-stressed polymer sheet. Self-folding takes advantage of 2D patterning techniques (e.g., lithography, inkjet printing) and converts predefined 2D templates into 3D structures. Self-folding is useful for packaging, actuation, and sensing. Most approaches to self-folding use hinges (regions that fold) that have unique chemical composition from the rest of the sheet, which requires photolithography or other multiple fabrication steps. Our approach employs homogeneous polymer sheets and inkjet printing. The black ink (i.e., the hinge) is patterned using a desktop printer on the sheet. Hinges absorb selectively the light to locally heat the underlying polymer and cause the shrinkage. We study experimentally the key physical parameters (hinge geometry, line width and support temperature) which affect the folding. We also explore various light and ink sources for folding complex 3D structures. Moreover, we model thermal profiles inside the polymer film, and investigate folding dynamics based on thermal shrinkage and rheological properties of polymer networks.

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