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Bending and Fracture in Thin Polymer Films during Capillary Origami Assembly. TIMOTHY TWOHIG, ANDREW CROLL, North Dakota State Univ — Capillary origami uses liquid tension to bend thin films into useful shapes and structures. The ability to scale this process to the microscopic range has led to growing interest in capillary origami and many potential applications. Clearly, the creation of three dimensional structures from flat sheets depends deeply on a combination of properties: fluid tensions, film thickness, film modulus and importantly the films fracture properties. Fractures in a film are a critical component of macroscopic origami but macroscopic methods for creating these fractures are not possible at the microscopic scale. We present an experimental investigation of the interplay of capillary forces and material properties in the creation of controlled fractures in thin polymer films. Specifically, we use capillary forces to lift and bend a thin polymer film to the point of fracture using a variety of film thicknesses and material properties and attempt to model the basic underlying physics. We observe the creation of delaminations and fractures at pre-determined sites that can be tailored to specific shapes to be utilized in capillary origami.

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