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Hysteretic self-folding of micro-scale polymer origami films JUNHEE NA, University of Massachusetts Amherst, JESSE SILVERBERG, Cornell University, ARTHUR EVANS, CHRISTIAN SANTANGELO, University of Massachusetts Amherst, THOMAS HULL, Western New England University, ITAI COHEN, Cornell University, RYAN HAYWARD, University of Massachusetts Amherst
— Origami-inspired self-folding materials have attracted interest for the design of actuators and remotely deployable devices. While well-established geometric rules have been used to create rigidly self-foldable origami structures, the behavior of non-rigidly foldable crease patterns remains incompletely understood. In particular, understanding the relationship between crease geometry and the resulting elastic energy barrier remains a central challenge. Here, we describe a simple model system based on the well-known square twist folding pattern to explore how self-folding structures overcome such energy barriers, and the resulting hysteresis in the folding/unfolding behavior. We show that the magnitude of the hysteresis can be tuned by variations in the plane angle characterizing the crease pattern, as well as by selectively weakening the panel diagonals to reduce the energy cost of bending. These results provide insights into geometrically-controlled energy barriers in non-rigidly foldable origami and design rules for the construction of bistable self-folding systems.

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