Electronic Supplementary Material (ESI) for Soft Matter

Supporting Information for:

Self-Folding of Polymer Sheets Using Local Light Absorption

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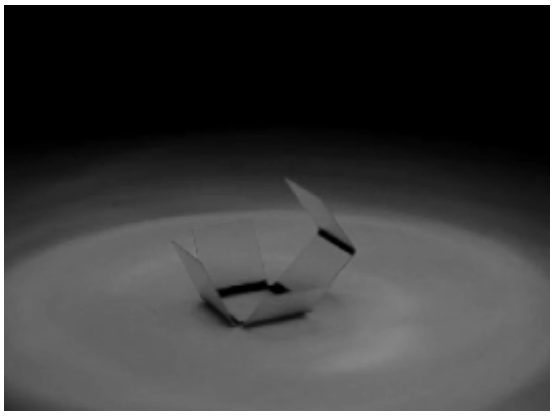

Video S1. This video demonstrates the self-folding of several structures with a T_S = 90 °C. For example, the cubic box features patterned line hinges (10 mm x 10 mm x 10 mm, w = 1 mm).

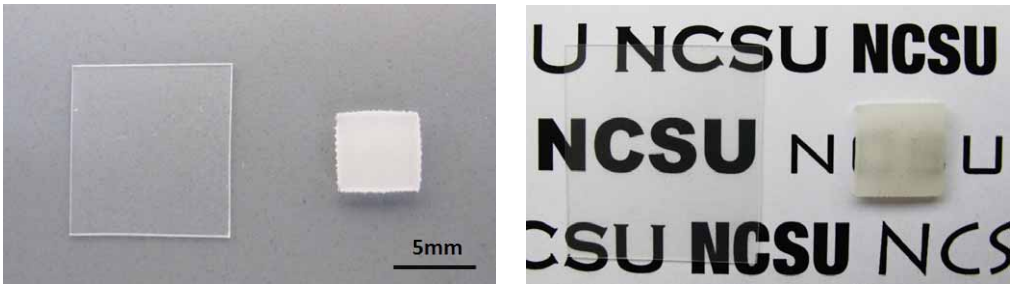

Figure S1. Photographs of Shrinky-Dink substrates like those used in this study. (left) A pristine substrate shrinks significantly in plane via uniform heating in the oven at 120 °C. (right) The pristine substrate is slightly hazy prior to shrinking, but transmits light effectively.

Table S1. Folding angles as a function of line width patterned across the narrow dimension of a Shrinky-Dink (L = 25 mm, L' = 10 mm).

Line Width (mm)	Folding Angle (°)
2.0	≈60
1.7	≈75
1.5	≈75
1.2	≈90
1.0	≈90
0.7	≈90
0.5	≈90

Table S2. Folding angles for double-line hinges as a function of line spacing on Shrinky-Dinks (25 mm x 10 mm). Two lines (each with a width of 1 mm) were patterned parallel to each other across the center of the sheet with a space placed between the lines.

Line Spacing (mm)	Folding Angle (°)
1	≈45
0.5	≈60
0.3	≈60

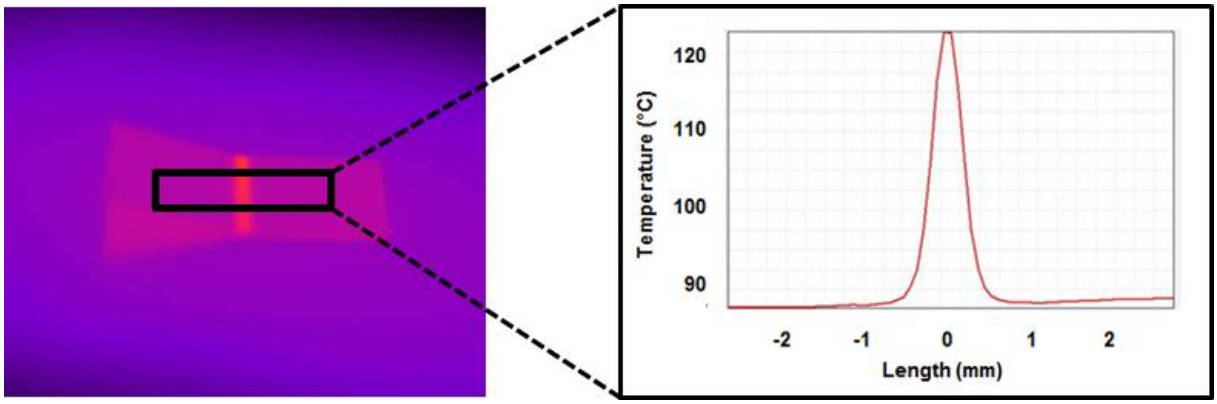

Figure S2. Thermal photograph (left) of a Shrinky-Dink (L = 25 mm, L' = 10 mm) taken using an infrared camera at the onset of folding. (right) The corresponding temperature profile defined in the black rectangle. It is apparent that the film is beginning to fold in this snap-shot. In this experiment, the substrate started with a support temperature of ≈80 °C prior to irradiation. The temperature is plotted as a function of distance along the axis perpendicular to the hinge. The temperature is largest in the middle of the line and reaches ≈120 °C when folding first initiates, yet quickly tapers off to the support temperature, which is important for rapid, selective heating of the hinge.

Figure S3. Photograph of a deformed box that is representative of the deformation that occurs to the panels when a sample is over-exposed to the light from the IR lamp.

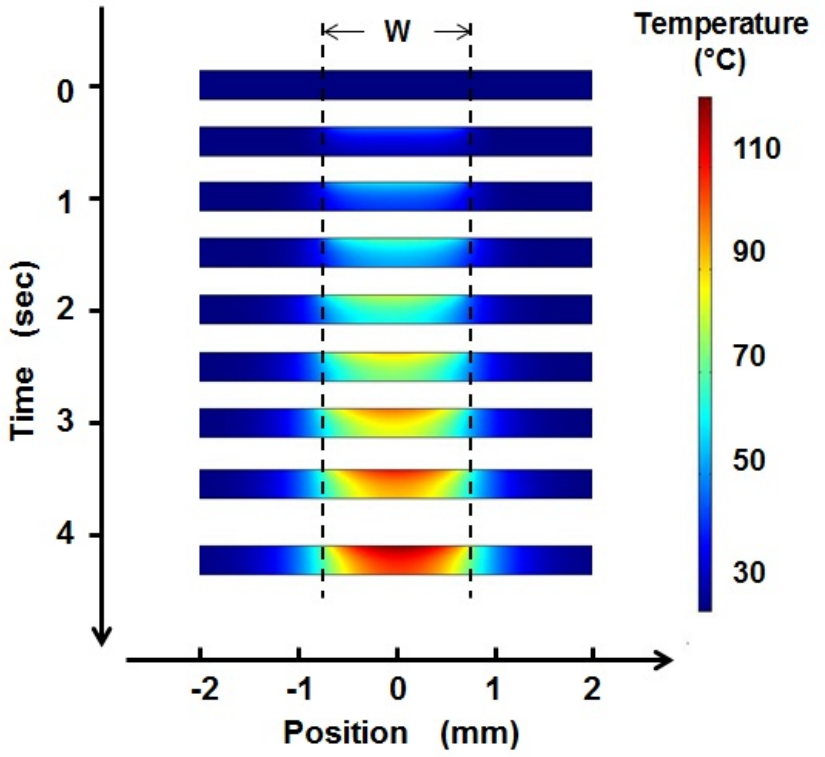

Figure S4. Colored maps of the modeled temperature profile in the cross-section of a Shrinky-Dink during the first 4.2 seconds of exposure at T_S = 20 °C. The heat originates from the top surface, which is the location of the ink. The two vertical dashed lines represents the patterned line width (w = 1.5 mm).

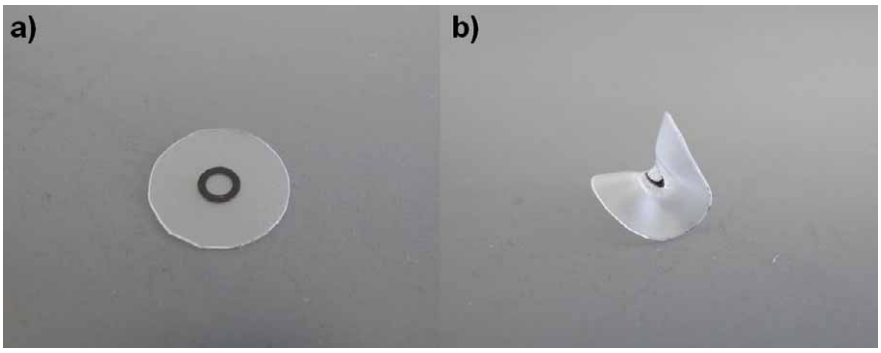

Figure S5. Photographs of (a) a 2D Shrinky-Dink (diameter 10 mm) patterned with black toner in the shape of a concentric circle (w = 1 mm, outer diameter 6 mm) and (b) the resulting 3D saddle structure that forms upon exposure to light.