Supporting Information for:

**Stretchable Organic Solar Cells**

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Stretchability of the Transparent Electrode. We first investigated the stretchability of the PEDOT:PSS alone. Figure S1a shows a plot of sheet resistance ($R_s$) as a function of strain for a 100-nm film of poly(3,4-ethylenedioxythiophene):poly(styrene sulfonate) (PEDOT:PSS) on a poly(dimethylsiloxane) (PDMS) substrate. The film had 96% transmittance at 550 nm. The resistance of the film when fully relaxed (buckled) decreased from 930 Ω/sq slightly to 750 Ω/sq when the strain equaled the pre-strain of 25% (the strain at which the buckles are planarized). Increasing the strain beyond the pre-strain produced cracks in the film and increased $R_s$ significantly and irreversibly. Figure S1b plots $R_s$ as a function of 1, 10, 100, and 1000 cycles of stretching from 0 to 25%. The value of $R_s$ remained close to 750 Ω/sq even after 1000 cycles of stretching. Figures S1c – S1e show PEDOT:PSS films while the substrate was pre-strained by 25% (S1c), after relaxing the pre-strain (S1d), and upon straining the film beyond 25% (S1e). The initially smooth PEDOT:PSS film on a pre-strained PDMS membrane adopted buckles with an approximate pitch of 6 µm upon release of the pre-strain, and cracks when stretched beyond the value of the pre-strain.

Apparatus for Straining Substrates and Devices. Figure S2 (top) shows photographs of the apparatus used for pre-straining the PDMS substrate during the fabrication process. We placed the PDMS membrane on a glass slide and clipped one end with a binder clip. We then marked the surface of the PDMS, stretched the membrane with tweezers to 50% of its original length, and clipped the free end with a second binder clip. Figure S2 (bottom) shows a homemade portable device used to stretch devices during photovoltaic measurements.

Deterioration of Devices when Over-Strained. When stretched beyond the value of the pre-strain, we observed irreversible degradation of the photovoltaic properties of the devices.
Figure S3 plots data from the same device represented in Figures 3b and 3c, but with strains greater than the pre-strain.

**Devices with Pre-Strain of 27%**. The most stretchable devices we fabricated were pre-strained to 27% and were reproducibly stretchable up to that amount. Figure S4 plots the current density v. voltage (J-V) of a device after one and ten full cycles of applied strain from 0% to 27%. The device had the architecture PDMS (~0.5 mm)/PEDOT:PSS (135 nm)/P3HT:PCBM (100 nm)/EGaIn. (P3HT is poly(3-hexylthiophene); PCBM is (6,6)-phenyl-C<sub>61</sub>-butyric acid methyl ester; EGaIn is eutectic gallium-indium.) The photovoltaic figures of merit after ten cycles of stretching are as follows: \( J_{SC} = 4.4 \text{ mA/cm}^2 \), \( V_{OC} = 365 \text{ mV} \), \( FF = 0.28 \), and \( PCE = 0.47\% \).

![Figure S1. Stretchable films of PEDOT:PSS. In panels (a) and (b), the upper and lower error bars each represent one standard deviation from the mean (N = 8 measurements at each value of strain on the same substrate).](image)
Figure S2. Photograph of a solar cell on a pre-strained PDMS membrane before deposition of the eutectic gallium-indium (EGaIn) top electrodes (top). Photograph of a purpose-built stage for applying strain to the devices (bottom).
Figure S3. Current v. voltage (I-V) plots of the same device represented in Figure 3b and 3c when strained beyond the value of the pre-strain (20%). There is a marked decrease in short-circuit current, fill factor, and power conversion efficiency.

Figure S4. Current density v. voltage (J-V) plots of the device with the largest pre-strain tested (27%) after one and ten cycles of stretching from 0% to 27%.