Science Advances

AAAS

Supplementary Materials for

Skin-like low-noise elastomeric organic photodiodes

Youngrak Park, Canek Fuentes-Hernandez*, Kyungjin Kim, Wen-Fang Chou, Felipe A. Larrain, Samuel Graham, Olivier N. Pierron, Bernard Kippelen*

*Corresponding author. Email: c.fuentes@northeastern.edu (C.F.-H.); kippelen@gatech.edu (B.K.)

This PDF file includes:

Figs. S1 to S5
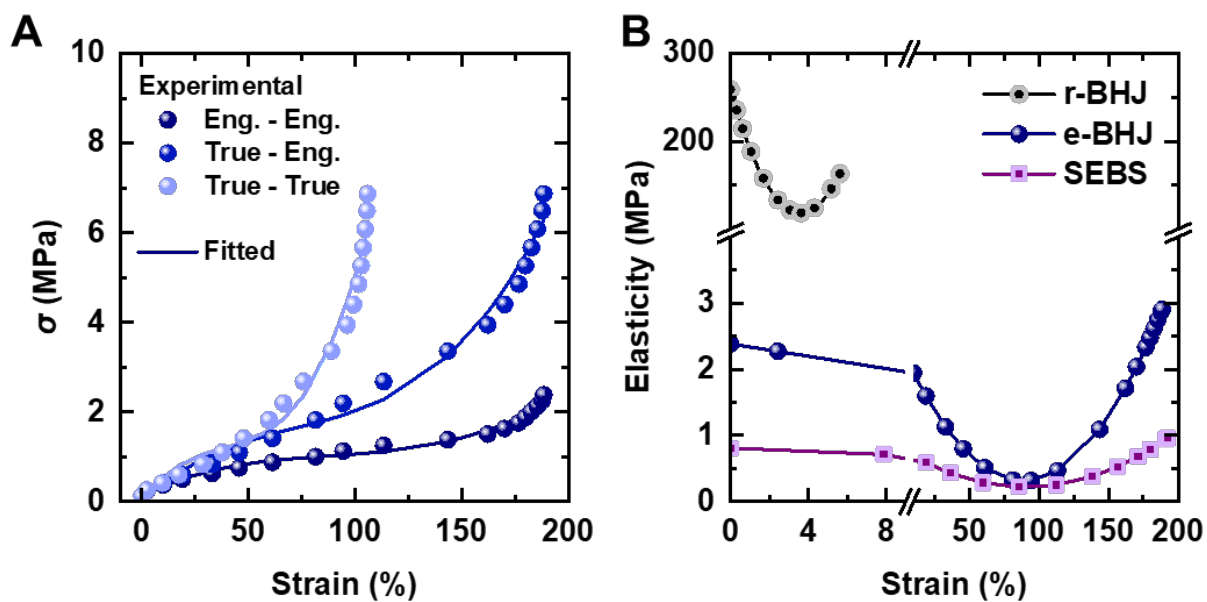Tables S1 and S2

Fig. S1.

Analysis of mechanical properties of freestanding films. (**A**) Comparison of experimental and fitted stress curve of e-BHJ. (**B**) Elasticity vs. strain plot derived from the engineering stress-strain curve.
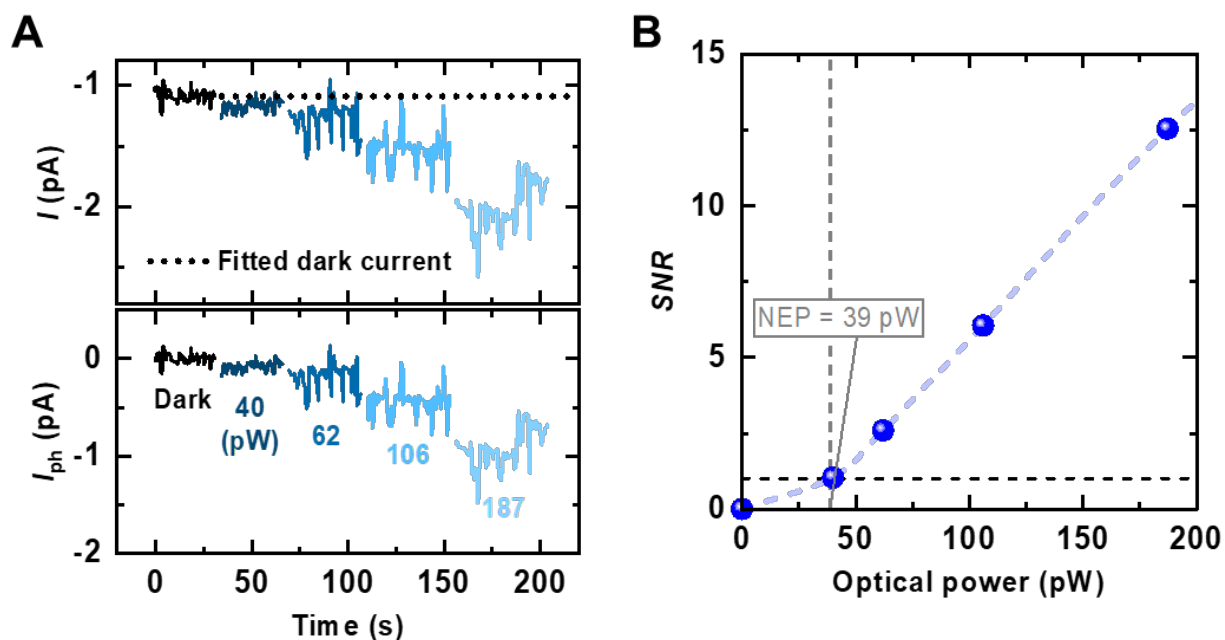
Fig. S2.

Analysis of photodetector metrics for OPD with e-BHJ on a rigid substrate. (**A**) Optical power dependence of transient current and photocurrent. (**B**) Optical power dependence of signal-to-noise ratio.
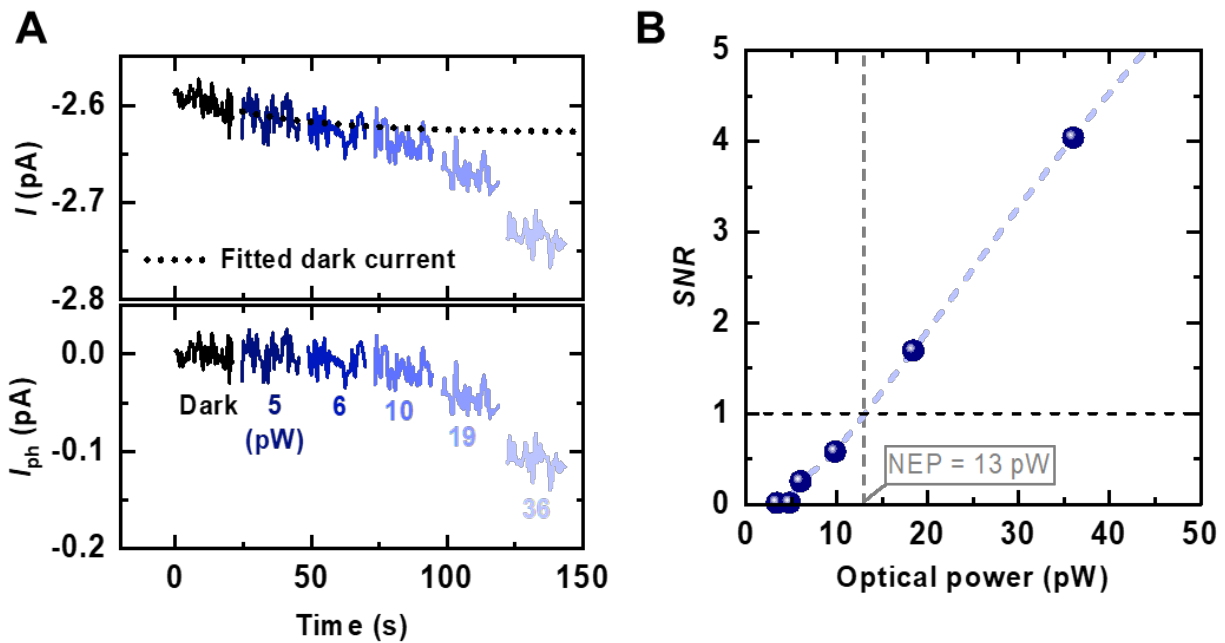
Fig. S3.
Analysis of photodetector metrics for unstrained e-OPD. (**A**) Optical power dependence of transient current and photocurrent. (**B**) Optical power dependence of signal-to-noise ratio.
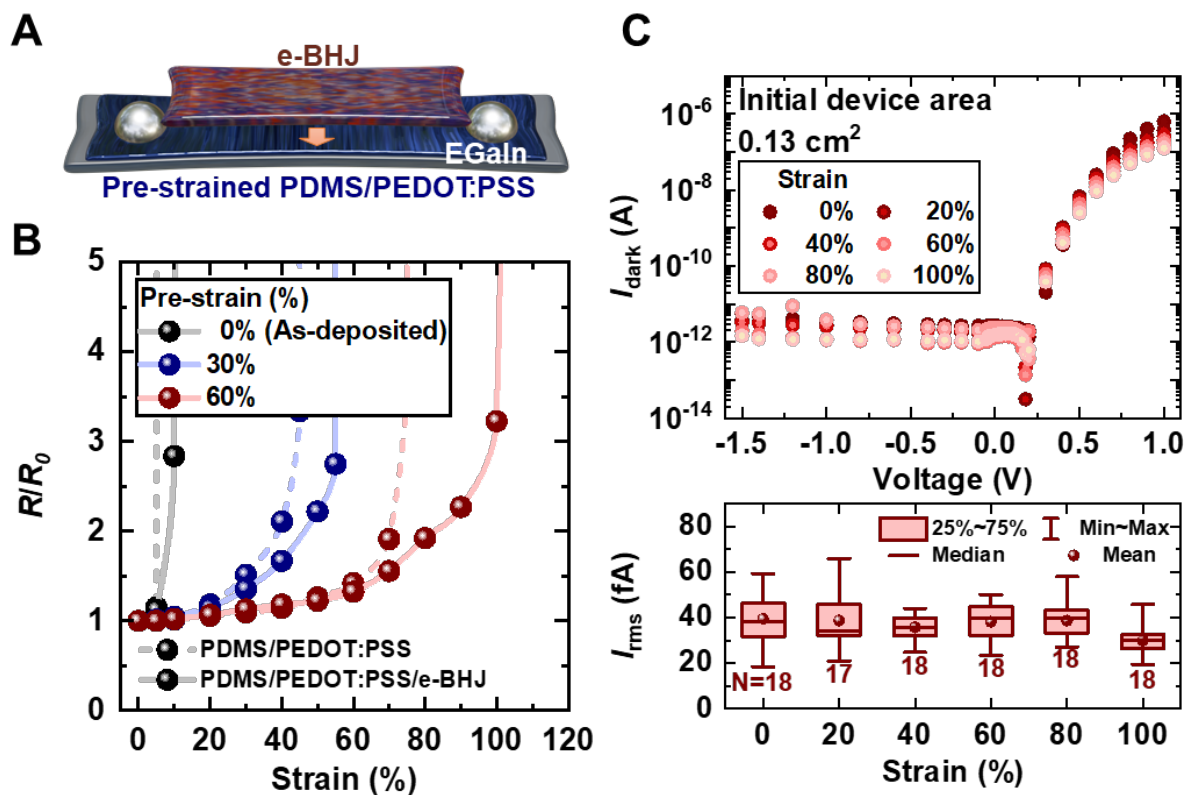
Fig. S4.
Improved stretchability of e-OPD using 60% pre-strained PDMS/PEDOT:PSS. (A)
Structure of pre-strained PDMS/PEDOT:PSS electrode. (**B**) Normalized resistance vs. strain plot
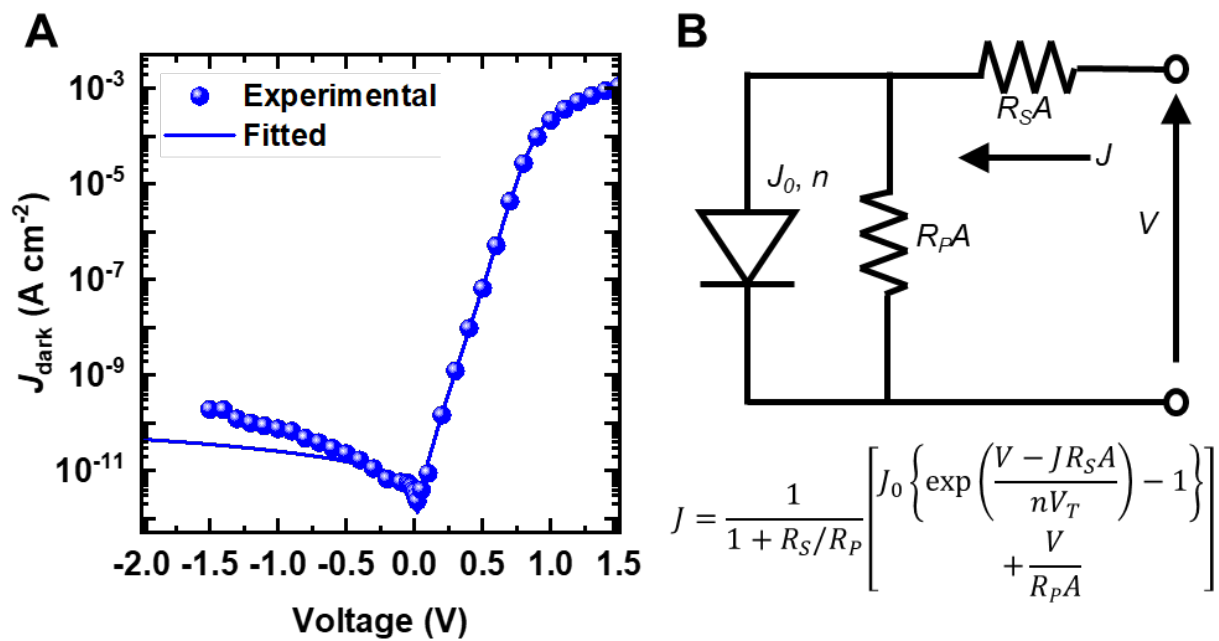(bottom). (**C**) Dark current (top) and root-mean-squared noise box plot (bottom).

Fig. S5.
Comparison of experimental and fitted dark current density using an equivalent circuit model for OPD with e-BHJ on a rigid substrate. (A) Experimental and fitted dark current density. (B) Equivalent circuit (top), corresponding equation (bottom), and physical parameters listed in Table S2.

$$J = \frac{1}{1 + R_S/R_P}\left[J_0\left\{\exp\left(\frac{V - JR_SA}{nV_T}\right) - 1\right\} + \frac{V}{R_PA}\right]$$

Table S1.

Elasticity at different strains of freestanding films extracted from the engineering stress-strain plots.

Freestanding films	Strain at break (%)	Elasticity at 0% (MPa)	Elasticity at 50% (MPa)	Elasticity at 100% (MPa)	Elasticity at 150% (MPa)
r-BHJ	6	259	-	-	-
e-BHJ	189	2.4	0.7	0.3	1.3
SEBS	192	0.8	0.3	0.2	0.5

Table S2.

Physical parameters of OPD with e-BHJ on a rigid substrate derived from an equivalent circuit model.

Reverse saturation current density, J_0 (pA cm^{-2})	Ideality factor, n	Series resistance, R_S (Ω)	Shunt resistance, R_P (Ω)
2.5	1.89	5×10^3	5×10^{11}