Electronic Supplementary Material (ESI) for Materials Horizons.

Supporting Information

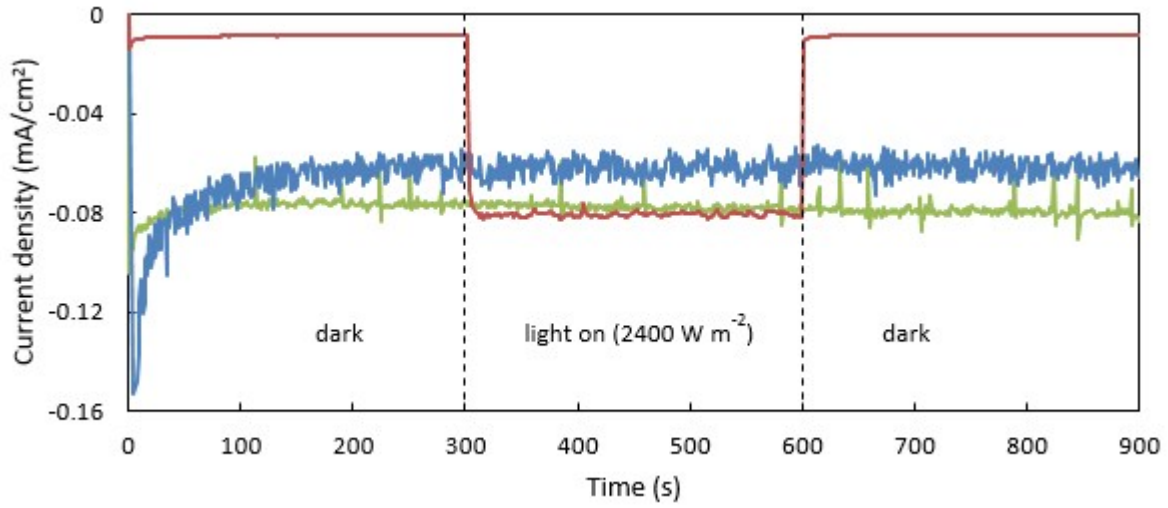

Figure S1. Standard three electrode measurements with SCE as reference and titanium mesh as counter electrode. Light enhancement chronoamperometry comparison of PEDOT:PSS (blue), poly(bithiophene) (red) and gold (yellow) electrodes on gold-Mylar in phosphate buffer solution (pH 7). The distance between the light source and the electrode was 2 cm and light irradiance 2400 W m^{-2}.

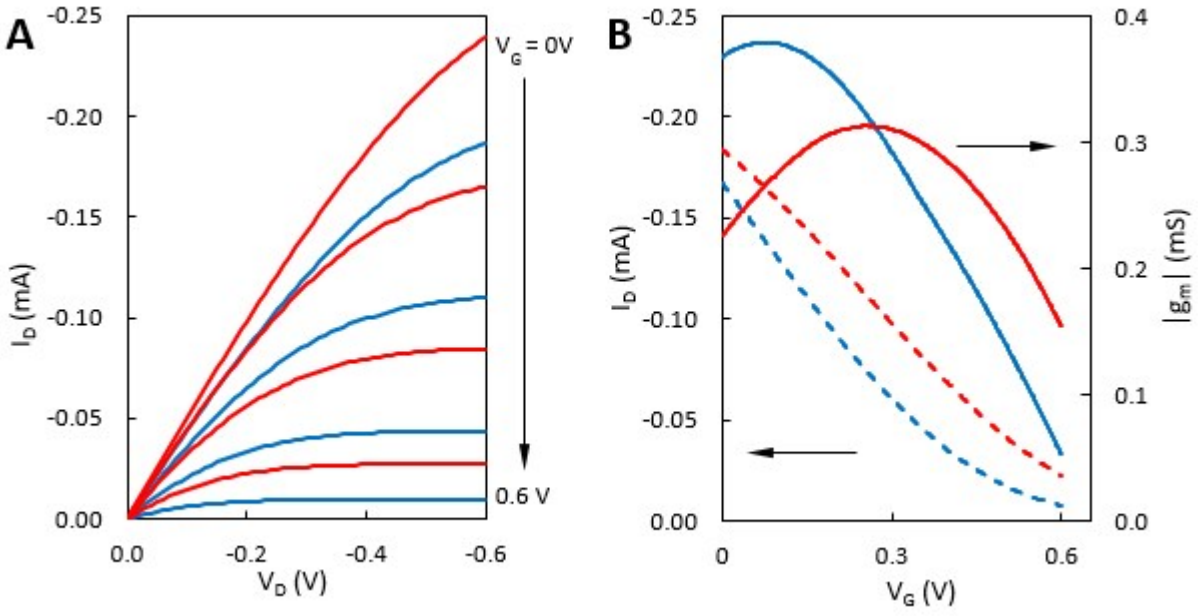

Figure S2. OECT performance. **(A)** OECT I-V characteristics performed in dark (blue) and light (red) at 1820 W m^{-2}. Gate voltage was varied from 0 to 0.6 V with a step of 0.2 V. Measurements performed in 0.1 M NaCl solution (pH 7). **(B)** Transfer curve (dashed line)

and associated transconductance (solid line) with (red) and without (blue) light for V_D = -0.6 V.

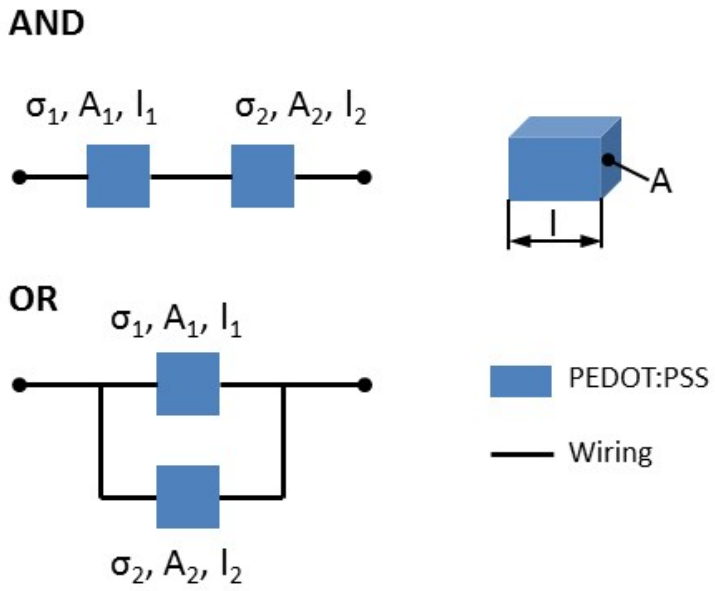

Figure S3. Schematics of two PEDOT:PSS channels connected in series (AND gate) and parallel (OR gate) and their properties; cross-section area, length and conductivity.

While cross-sectional area and channel length are the same for both transistors ($A_1 = A_2 = A$; $l_1 = l_2 = l$), conductivity values can differ and are dependent on channel doping level and light irradiance, hence

$$G_1 = \sigma_1 \frac{A}{l}; G_2 = \sigma_2 \frac{A}{l} \qquad \text{(S1)}$$

The overall conductance (G) for serial connection (AND gate) is given by equation

$$\frac{1}{G} = \frac{1}{G_1} + \frac{1}{G_2} = \frac{l}{\sigma_1 A} + \frac{l}{\sigma_2 A} \qquad \text{(S2)}$$

hence

$$G = \frac{\sigma_1 \sigma_2}{\sigma_1 + \sigma_2} \frac{A}{l} \qquad \text{(S3)}$$

Similar conductance equation can be derived for parallel connection (OR gate), where

$$G = G_1 + G_2 = (\sigma_1 + \sigma_2)\frac{A}{l} \qquad \text{(S4)}$$

Above equations explain opto-logic gate behavior and the difference in obtained current values (fig. 3).

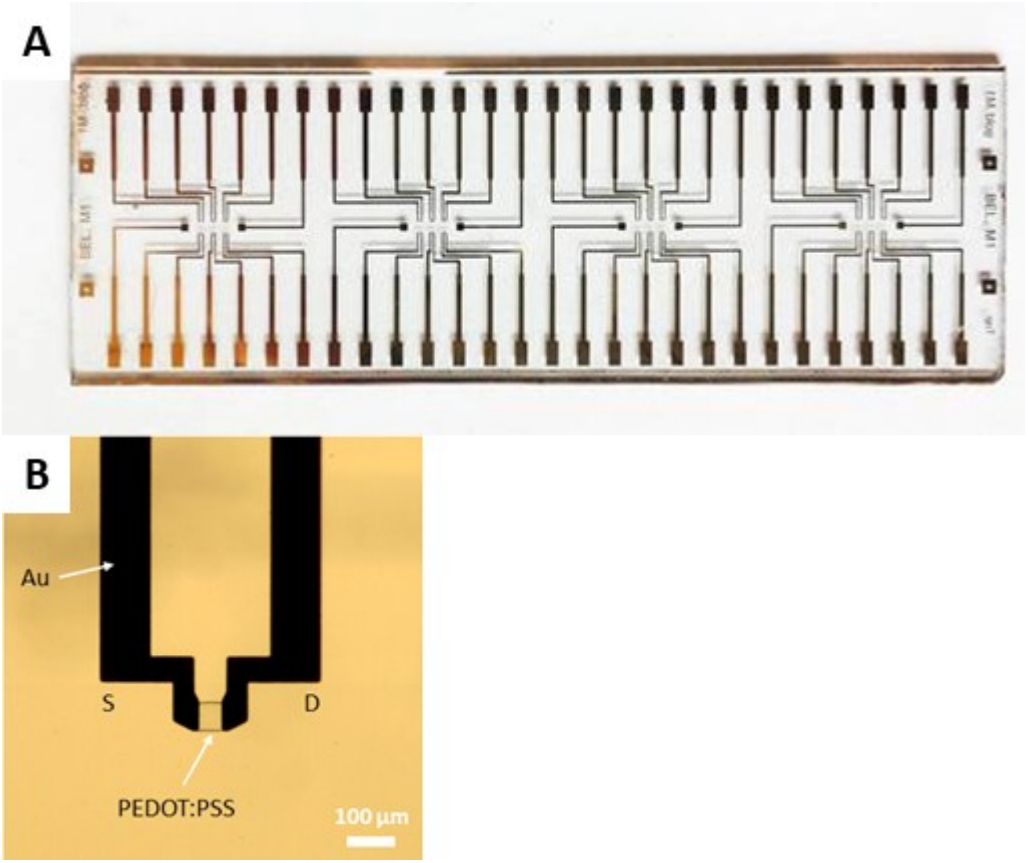

Figure S4. Picture of PEDOT:PSS channel. (A) Real scale photo of multiple channel array. (B) Microscope image of the channel.