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POS-20 - Visualizing in situ Electrochemical Doping in Luminescent Conjugated Polymers

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Light-emitting conjugated polymers can be electrochemically p- and n-doped *in situ* in a device called the polymer light-emitting electrochemical cell (PLEC). [1] Electroluminescence occurs through the injection of minority charge carriers when the doped polymers make contact and form a p-n junction. This doping and junction formation make PLEC fundamentally different from the widely studied organic or polymer light-emitting diodes (PLEDs or OLEDs). [2] Bipolar electrochemistry is an electrochemical phenomenon where a polarized conducting object inside an electric field that will induce redox reactions at its extremities if sufficient potential difference is applied. [3] The conducting object is called bipolar electrode which promotes electrochemical reactions at its extremities even in absence of a direct ohmic contact. Our group first presented a solid-state, polymer-based, light-emitting electrochemical cell incorporating metallic bipolar electrodes positioned between the driving electrodes. [4] The inclusion of bipolar electrodes can lead to more efficient polymer light-emitting when a large number of active junctions are formed. Further study showed that electrochemical phenomenon can be observed to originate from the previously doped regions that are isolated from the driving electrodes. A pair of biased metallic probes is in direct contact with the exposed polymer surface, which cause *in situ* electrochemical p- and n-doping of the luminescent polymer in the interior of an electrochemical cell. After applying sufficient voltage to the driving electrodes, p- and n-doping were observed from the extremities of doped luminescent conjugated polymer. By analyzing the complex doping patterns generated, we conclude that the doped polymers have functioned as bipolar electrodes, from which electrochemical p- and n-doping are induced wirelessly.

1. Pei, Qibing, et al. "Polymer light-emitting electrochemical cells." Science 269.5227 (1995): 1086.
2. Pei, Qibing, and Alan J. Heeger. "Operating mechanism of light-emitting electrochemical cells." Nature materials 7.3 (2008): 167-167.
3. Fosdick, Stephen E., et al. "Bipolar electrochemistry." Angewandte Chemie International Edition 52.40 (2013): 10438-10456.
4. Chen, Shulun, et al. "Solid-State Bipolar Electrochemistry: Polymer-Based Light-Emitting Electrochemical Cells." ChemElectroChem (2015).

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