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Spin-polarized organic light emitting diode based on a novel bipolar spin-valve¹

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The spin-polarized organic light emitting diode (spin-OLED) has been long sought device within the field of organic spintronics. We designed, fabricated and studied a spin-OLED with ferromagnetic (FM) electrodes that acts as a bipolar organic spin valve (OSV), based on deuterated derivative of poly(phenylene-vinylene) with small hyperfine interaction [1]. In the double-injection limit the device shows $\sim 1\%$ spin-valve magneto-electroluminescence (MEL) response that follows the FM electrode coercive fields, which originates from the bipolar spin-polarized space charge limited current [2]. In stark contrast to the response properties of homopolar OSV devices, the MEL response in the double-injection device is practically bias voltage independent, and its temperature dependence follows that of the FM electrode magnetization. Our findings provide a pathway for organic displays controlled by external magnetic fields.

[1] T. D. Nguyen, G. Hukic-Markosian, F. Wang, L. Wojcik, Xiao-Guang Li, E. Ehrenfreund, Z. V. Vardeny, "Isotope effect in spin response of π -conjugated polymer films and devices," *Nature Materials* 9, 345-352 (2010)

[2] T. D. Nguyen, E. Ehrenfreund and Z. V. Vardeny, "Spin-polarized organic light emitting diode based on a novel bipolar spin-valve," *Science* 337, 204 (2012)

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