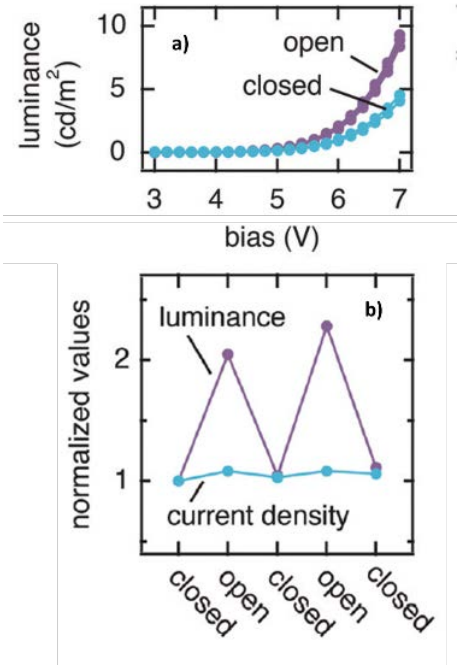
Modulating the luminance of organic light-emitting diodes via optical stimulation of a photochromic molecular monolayer at transparent oxide electrode

Organic self-assembled monolayers (SAMs) deposited on inorganic bottom electrodes are commonly used to tune charge carrier injection or blocking in hybrid inorganic/organic optoelectronic devices. Beside the enhancement of device performance, the fabrication of multifunctional devices in which the output can be modulated by multiple external stimuli remains a challenging target. The authors of this research highlight report the functionalization of an indium tin oxide (ITO) electrode with a SAM of a photochromic diarylethene derivative designed for optically control the electronic properties. Following the demonstration of dense SAM formation and its photochromic activity, as a proof-of- principle, an organic light-emitting diode (OLED) embedding the light-responsive SAM-covered electrode is fabricated and characterized. Optically addressing the two-terminal device by irradiation with ultraviolet light (315 nm) doubles the electroluminescence (100% gain), which can be reversed by irradiation with visible light (530 nm). This approach of “dynamic” energy tuning could be successfully exploited in the field of opto-communication technology, for example to fabricate opto-electronic logic circuits. which hold great potential for quantum information applications.



a) *Luminance of an OLED fabricated with a SAM-modified ITO electrode. The luminescence doubles once the DAE is switched from closed to open.*
b) *Values for the ratio between the current densities and luminescence measured at 5 V upon multiple irradiation cycles. The Modulation of the OLED luminescence is reversible*

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