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Cavity Effect in Low Volage Operating Organic Field Effect Transistors

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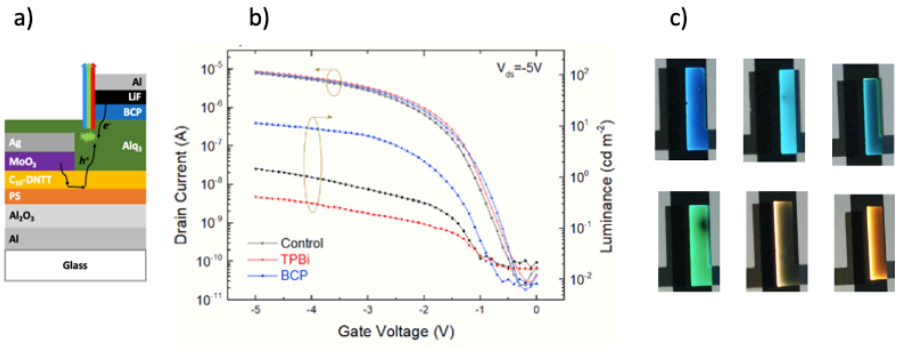
Abstract:

The study of organic electronics is meant to reach ways to produce electronics with alternative processes than inorganic electronics, easier to fabricate with low costs. Among many organic electronic devices, such as Organic Field Effect Transistor (OFET), Organic Light Emitting Diodes (OLED) or also Organic Photovoltaics (OPV), a particular device called "Organic Light Emitting Transistor" (OLET) is the object of recent studies. An OLET is the combination of the switching properties of an OFET with the light emitting properties of an OLED. Therefore, OLET is considered to have a great potential either for display technologies or for lasing applications.(1) Here, we present our recent study where two hole blocking molecules were integrated into Alq_3 based light emitting transistors under operating voltage as low as 5 V. The effects of hole blocking and electron injection were decoupled through the differences in the energy levels of these molecules.(2) In the follow up study, the thickness of the emissive layer was varied. By doing so, a tuning of the color was observed, going from blue to red with the exact same molecule, emitting normally in the green. A resonant cavity phenomenon was actually taking place in the structure. Optical simulations have been carried out to understand the mechanism.



a) OLET device structure in our study; b) Transfer and luminance curves of OLETs; c) Color tuning following the change in the thickness of the emissive layer

References:

(1) M. Muccini "A bright future for organic field-effect transistors." Nature materials 5.8 (2006): 605-613.

(2) A. Bachelet, M. Chabot, A. Ablat, K. Takimiya, L. Hirsch and M. Abbas, "Low voltage operating organic light emitting transistors with efficient charge blocking layer" Organic Electronics (2021) 88, 106024.