Prof. Holger Frauenrath
EPFL – STI – IMX – LMOM, Station 12
1015 Lausanne, Switzerland

Phone: + 41 21 693 7399
Fax: + 41 21 693 5270
E-mail : holger.frauenrath@epfl.ch

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Organic Electronic Materials

Exercise 11

1. Explain in detail the mechanism of light emission in an organic light emitting diode. What are the difference and analogies between luminescence and electroluminescence? What is the ideal device structure for high power efficiencies?

2. Despite the difficulty to fabricate OLEDs with a multi-layer architecture, there are several advantages that motivate their production. What are these advantages?

3. Generally speaking, what is the difference between current and power efficiency? Which type of information can we extrapolate from them?

4. How can the color of an OLED be tuned? What would you need to produce a white-light OLED? Which factors have to be controlled in order to achieve the right color purity? Explain the mechanisms that negatively affect color purity, and how we can suppress/reduce them.

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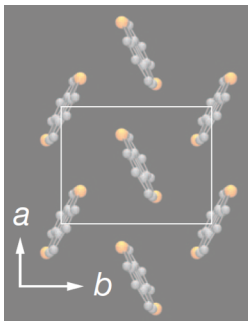
Exercise 12

1. What is the function of a transistor and in which applications can a thin film transistors (TFTs) be found? Draw a schematic illustration of a bottom gate, top contact OTFT. Name all the parts and give examples of possible constituent materials.

2. Shortly describe the working principle of a thin film transistor.

3. A typical value for the amount of accumulated charge carriers in an OTFT in the on-state is 10^{13} cm^{-2}. What is the percentage of charged molecules in an OTFT based on a single layer of C_8-BTBT, with herringbone packing (image on the right) and crystal lattice parameters of a=5.9 Å and b=7.9 Å?



4. Draw an output curve of a p-type OTFT. Mark the typically observed working regimes (without the transition regime) of the transistor and explain the reason for these different working regimes.

5. Draw a transfer curve for a typical n-type TFT. Which parameters can be extracted from the transfer curve (and $\sqrt{I_D}$ vs V_G curve) and how?

6. How can the active parts of OFTFs (electrodes, dielectric, semiconductor) be processed and patterned?