LAB MODULE 2 OF 4: POLYMER LED : PRE-LAB QUESTIONNAIRE

NAME:_____

Fabrication and Characterization of a Liquid Crystal Display Pixel

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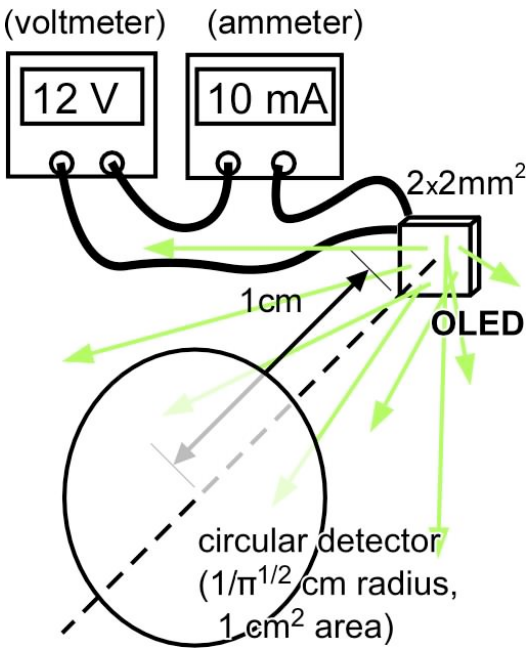
On Calculating Radiance & Efficiency Properties

1. Consider the organic LED (shown at right) under test for lighting applications. This research-prototype has an emission area of 4 mm^2, emits with a center wavelength of 580 nm, and has the voltage and current shown. An optical power meter (also shown) measures 0.5 mW, has a circular area of 1 cm^2 and is positioned 1 cm away from the LED. Note that this is <u>not</u> the total optical power emitted by the LED because not all light is collected the detector. Calculate the following:



a. Total <u>electrical power</u> (in mW)

b. Total <u>solid angle</u> of the detector (in sr)
(you can consider the LED to be a point source)

c. Total radiant flux (or optical power) of the OLED (in mW)
(for this you should approximate uniform emission into all directions $B(\theta,\phi)=B_0$, which basically allows you to multiply the optical power (0.5mW) by the ratio [2π / part(b)])

d. Total irradiance of the OLED (in W/m^2)
(remember to convert the 4 mm^2 into an area with units of m^2, and mW to W)

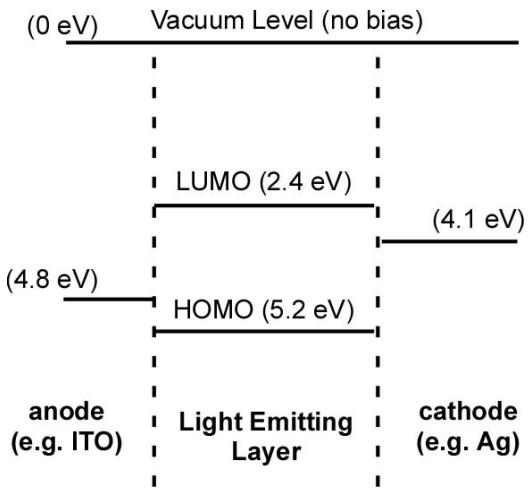
e. Total luminous flux (or photopic power) (in lm)
(for this you can approximate that all light from the OLED is emitted at 580 nm, and that the radiometric to photopic conversion is 594 lm = 1 W)

f. Total power efficiency (in lm/W)
(remember this is part(e) / part(a))

g. Total luminance (in cd/m^2 = $lm/sr\text{-}m^2$)
(remember to convert to area with units of m^2)

On the Band Diagram Calculations

2. Consider the band diagram shown at right for a typical single-layer polymer LED. Calculate the following:



a. Electron injection barrier (in eV)

b. Hole injection barrier (in eV)

c. Built-in voltage (in V)

d. Likely color of LED (red, green or blue)