Hole Mobility Measurements of Poly(N-vinylcarbazole)

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Motivation

- Understanding charge transport and mobility within organic materials is crucial to design and improve such applications as organic light-emitting diode (OLED).
- Poly(vinylcarbazole) (PVK) has been widely used as a host material in molecularly doped OLEDs.
- This investigation focused on studying charge mobilities in PVK films doped with electron transport materials to understand the influence of concentration of doping material on the efficiency of electrophosphorescent devices.
Time of Flight

Sample Between two Electrodes on glass slides

\[ d = vxt \]

where, \[ v = \mu E = \frac{\mu V}{d} \]

\[ d = \frac{\mu Vt}{d} \]

\[ \mu = \frac{d^2}{Vxt} \]
Time of Flight
Time of Flight
PVK (220 V)

Drift Mobility
\[ \mu = \frac{d^2}{Vt} \]
Sample Preparation

- Substrates for the samples were prepared by cutting one-inch square glass slides coated with Indium Tin Oxide (ITO).
- Afterwards, half of the ITO was chemical etched away by placing resistive tape on one side of the sample and exposing the other half to a reaction of HCl and MgCl2.
- Furthermore, the organic material, PVK, was dissolved in chlorobenzene and spin coated onto the substrate.
- Finally, aluminum was deposited on the film by thermally evaporating the metal onto the substrate using physical vapor deposition.
Sample
Apparatus
μ(holes) vs. $E^{1/2}$ graph for PVK

- Device: PVK90
- Thickness 4.6 μm

<table>
<thead>
<tr>
<th>Slope (β)</th>
<th>$μ_o$ [cm$^2$/Vs]</th>
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</thead>
<tbody>
<tr>
<td>0.003099</td>
<td>$3.7 \times 10^{-8}$</td>
</tr>
<tr>
<td>0.00349</td>
<td>$6.0 \times 10^{-8}$</td>
</tr>
<tr>
<td>0.00420</td>
<td>$4.6 \times 10^{-8}$</td>
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<tr>
<td>0.00524</td>
<td>$1.8 \times 10^{-8}$</td>
</tr>
</tbody>
</table>

$μ = μ_o e^{(β\sqrt{E})}$

* Mobility depends of Electric Field
Conclusion

- The methods used to make devices using electron beam deposition did not produce good devices (Devices shorted).
- The drift mobility of the samples were of the same order of magnitude in published data*. 

Lesson Plan: Solar Cell

- Students will measure the current generated by a solar cell by applying different voltages to the device.

- Students will be able to graph I vs V curves for different colors of lights.

- Students will calculate the maximum power point of a solar cell.

- Students will calculate the efficiency of a solar cell.
Acknowledgement

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