

# Chemistry of Organic Electronic Materials

6483- Fall 2012

Tuesdays and Thursdays: 9:35-10:50 am  
Lecture Room 1201A, MoSE Building

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The goal of this course is to provide a broad description of the basic chemical and physical concepts that determine the properties of electrically active organic materials.

The discussion will include aspects of synthesis, electronic structure, physico-chemical characterization, and device applications.



Example of a flexible organic light-emitting diode (OLED) (from the Center on Organic Photonics and Electronics at Georgia Tech) and of an ultra-thin 55-inch OLED television coming on the market this fall (from LG)

## Topics to be discussed in class

- ❖ General introduction to the electronic structure of organic materials with connection to their electrical properties and optical absorption
- ❖ Electrically conducting polymers
  - Basic concepts of conductivity
  - Introduction to the concepts of polarons and solitons
  - Evolution of electronic structure upon doping (polyacetylene; polypyrrole)
- ❖ Excited states
  - At the molecular level
    - fluorescence
    - phosphorescence
  - At the condensed-phase level
- ❖ Electron transfer
  - General introduction to Marcus Theory
    - energy transfer
    - electron transfer
- ❖ Theory of charge transport and mobility in organic materials
  - Band regime vs. hopping regime
  - Electron-vibration couplings
- ❖ Luminescent materials
  - Basic concepts of light absorption and emission
  - Electroluminescence
  - Impact of interchain/intermolecular interactions
  - Luminescent organic  $\pi$ -conjugated polymers and coordination complexes
- ❖ Organic electronics
  - Applications of  $\pi$ -conjugated materials in organic light-emitting diodes
  - Applications of  $\pi$ -conjugated materials in organic solar cells
  - Applications of  $\pi$ -conjugated materials in organic field-effect transistors

## Assignments

Assignments will take the form of reading a number of recommended review papers.

There will be two mid-term exams on Sept. 20 and Oct. 25 (during normal class hours). The final exam (on Dec. 13) will be cumulative. In each instance, study guides will be provided.

### Grading:

First mid-term: 100 points.

Second mid-term (cumulative): 150 points.

Final (cumulative): 250 points.

Total: 500 points.

Class #	Date	Topic
1	Aug. 21	Introduction – Electronic Structure of Organic Materials
2	Aug. 23	Electronic Structure of Organic Materials
3	Aug. 28	Electronic Structure of Organic Materials
4	Aug. 30	Intro to $\pi$ -Conjugated Materials
5	Sept. 04	Intro to Electron Transfer Theory (VC)
6	Sept. 06	Intro to Electron Transfer Theory (VC)
7	Sept. 11	Conducting Polymers
8	Sept. 13	Conducting Polymers
9	Sept. 18	Conducting Polymers
10	<b>Sept. 20</b>	<b>Mid-term I</b>
11	Sept. 25	Intro to Luminescence Phenomena
12	Sept. 27	Organic Light-Emitting Materials and OLEDs
13	Oct. 02	Organic Light-Emitting Materials and OLEDs
14	Oct. 04	Organic Light-Emitting Materials and OLEDs
15	Oct. 09	Impact of Interchain/Intermolecular Interactions
16	Oct. 11	Impact of Interchain/ Intermolecular Interactions
17	<b>Oct. 16</b>	<b>Fall Break</b>
18	Oct. 18	Transport Properties
19	Oct. 23	Transport Properties (CR)
20	<b>Oct. 25</b>	<b>Mid-term II</b>
21	Oct. 30	Transport Properties (CR)
22	Nov. 01	Transport Properties / Metal-Organic Interfaces
23	Nov. 06	Metal-Organic Interfaces
24	Nov. 08	Metal-Organic Interfaces
25	Nov. 13	<b>NO CLASS</b>
26	Nov. 15	Organic Transistors
27	Nov. 20	Organic Solar Cells
28	Nov. 22	<b>THANKSGIVING</b>
29	Nov. 27	Organic Transistors (VC)
30	Nov. 29	Organic Solar Cells
31	Dec. 04	Organic Solar Cells
32	Dec. 06	Review for final exam
33	<b>Dec. 13 (Thursday)</b>	<b>Final Exam 8:00-10:50am</b>