Student Affiliates of the American Chemical Society (SAACS)
Meeting Minutes: Meeting #3: 11-19-03

Introduction:

John Anthony, PhD from the UK Dept. of Chemistry is introduced by Dr. Walters. John Anthony first did his undergraduate work at Reed College in Portland, Oregon. Then he received his PhD and post-doc at UCLA.

Presentation:

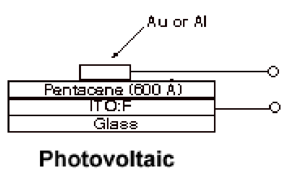
Title: “Organic Electronics: No pesticides were used in the construction of this computer"

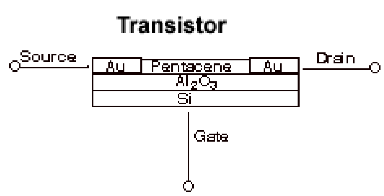
Why choose carbon to do electronics in things such as computer chips instead of silicon?

- Carbon is right above Si in the periodic table, which means that they both have somewhat similar properties, respectively.
- There is a much richer chemistry with carbon compounds.
- It is cheaper to use carbon compounds.
- Carbon compounds are soluble.

Applications:

- Photo-voltaics (Plastic Solar Cells): used for a cheap source of energy
- Transistors (organic field-effect transistors): the basic components of all microelectronics and the “on-and-off” switch

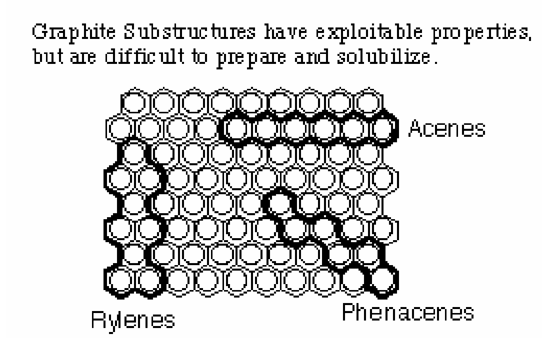




- OLEDS (light-emitting diodes): used for large-area flat panel light displays or flexible computer displays.

Carbon Semiconductors:

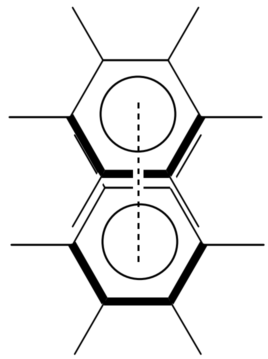
- Graphite (solely a carbon containing compound) is highly conductive but it isn’t soluble….
- So, John Anthony’s group is making sub structures of graphite such as: phenacenes, acenes, and rylenes.



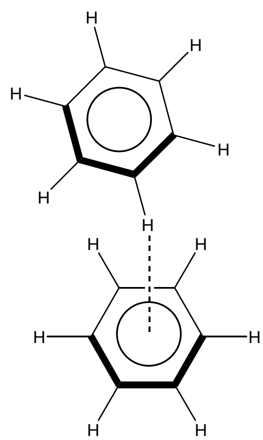
- Phenacenes are insulators.
- Acenes are semiconductors and their electronic properties improve rapidly with oligometric size.
- Rylenes are insulators but more so semiconductors and are hard to make.

Idea behind John Anthony's Research:

They want to make structures that have overlapping π clouds such that π clouds can interact and carry electron density such like this:

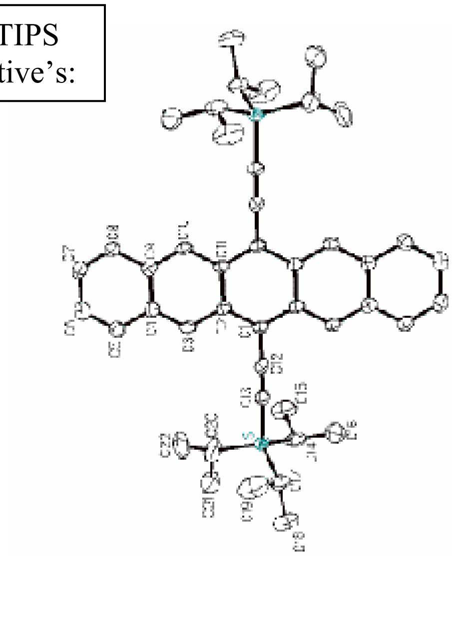


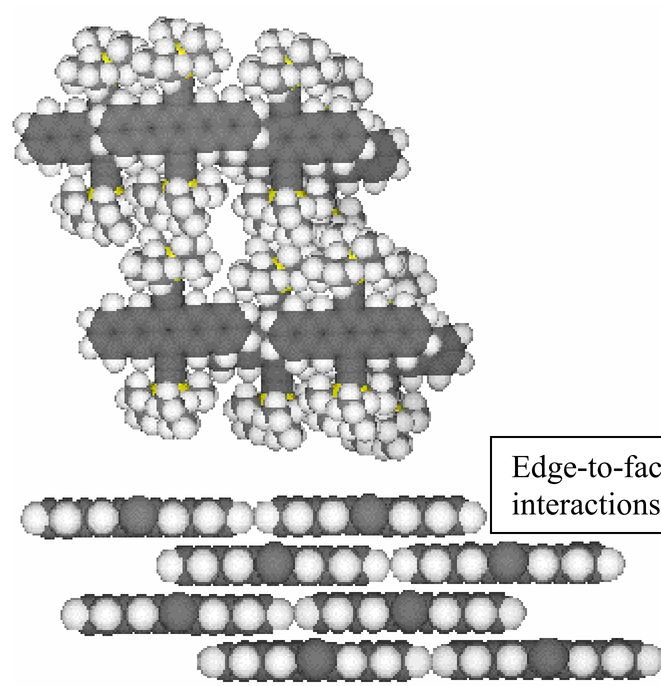
However, many problems can arise with making these compounds, such as the one depicted below:



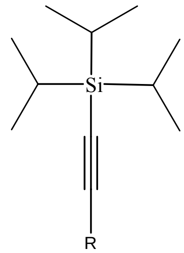
Pentacene's: "The big ones"

Using TIPS Derivative's:



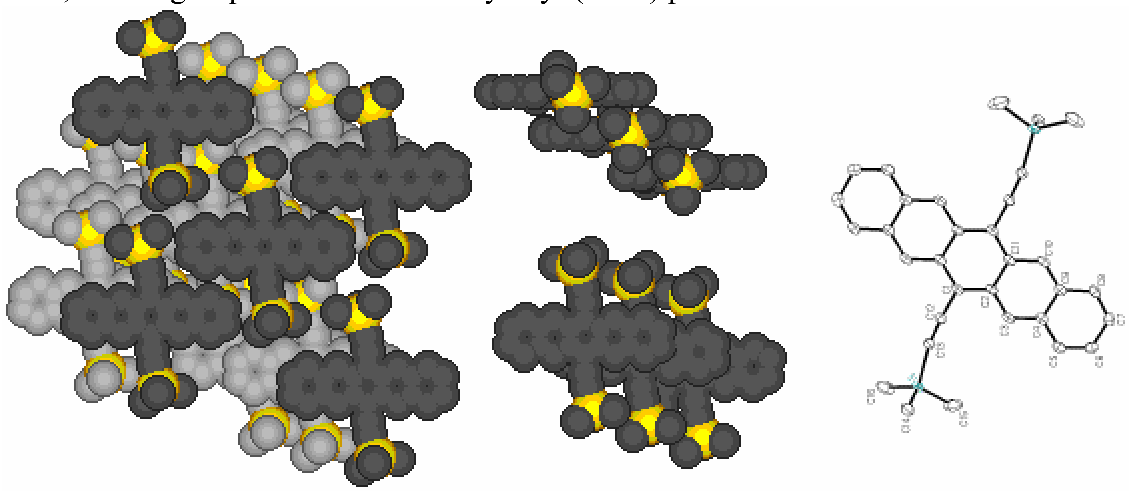


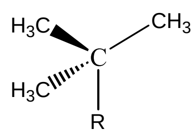
Edge-to-face interactions



TIPS

Also, John's group has tried a trimethylsilyl (TMS) pentacene derivative:





TMS

By manipulating the solid-state order of the pentacene's, John's group has been able to increase the conductivity by more than 8 orders of magnitude! In addition, this simultaneously makes them more oxidatively (and photochemically) stable in the solid state.

Problems with pentacenes:

- Very expensive.
- Very unstable.
- Insoluble in almost every solvent.
- It has edge-to-face interactions in the trimethylsilyl (TMS) derivative and only one group overlaps in the triisopropylsilyl (TIPS) derivative.

Note: All the material in this report is from the work of John Anthony, PhD of University of Kentucky.

For more information on John's work visit his website:
http://www.chem.uky.edu/research/anthony/welcome.html