

# Organic Semiconductors

By  
Major Smith

# Objectives

- What are Organic Semiconductors?
- How are they made?
- What are they good for?

# Overview

- An organic semiconductor is any organic material that has semiconductor properties. There are two classes of organic semiconductors: charge-transfer complexes and linear backbone polymers. Have been used with inorganic semiconductors and now are being researched.

# Polymers

- Consists mostly of polyacetylene, polypyrrole, polyaniline and their derivatives.
- Physical composition leads to the development of LUMO (Lowest Unoccupied Molecular Orbital) and HOMO (Highest Occupied Molecular Orbital).
- Doped chemically, electrochemically or self doped.

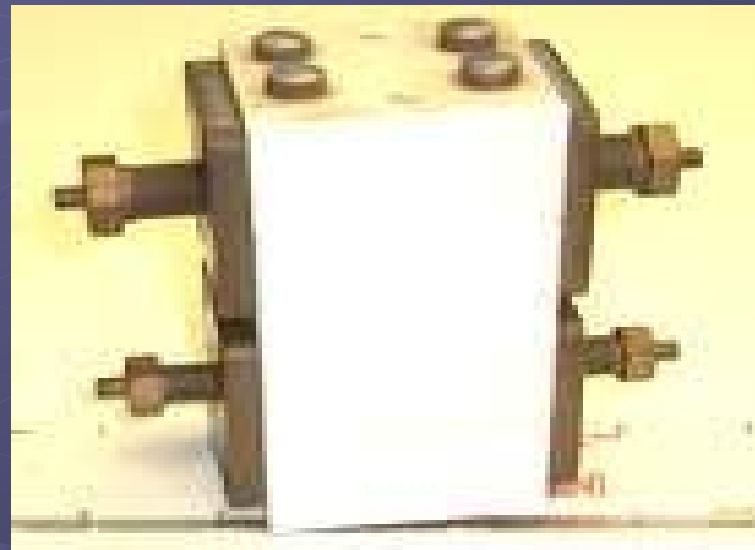
# Polymers

## ● Early Works

1963 DE Weiss and coworkers reported high conductivity in polypyrrole.

1974 John McGinness and coworkers built and reported the voltage-controlled organic-polymer switch.

1977 Shirakawa, Alan G. MacDiarmid, Alan J. Heeger reported high conductivity in polyacetylene which led to awarding of the 2000 Nobel prize in Chemistry.



Organic polymer voltage-controlled switch created in 1974.

# Polymers

- Applications

Flat Panel Displays using OLED's

Solar Panels

Optical Amplifiers

Transistors - OFET

# Charge-Transfer Complexes

- An electron-donor–electron-acceptor complex, characterized by electronic transitions to an excited state in which there is a partial transfer of electronic charge from the donor to the acceptor.
- Made by pairing an electron donor molecule with an electron acceptor molecule.
- Superconductors can be made at low temperatures.



# Charge-Transfer Complexes

## ● Early Works

1954 Bell Lab researchers and others report charge-transfer complexes

1962 a acceptor, tetracyanoquinodimethane (TCNQ) was reported.

1970 a donor, tetrahydrofulvalene (TTF), was synthesized.

1973 A charge-transfer complex of (TTF)-(TCNQ) was discovered



# References

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- [http://en.wikipedia.org/wiki/Charge\\_transfer\\_complex#cite\\_note-4](http://en.wikipedia.org/wiki/Charge_transfer_complex#cite_note-4)
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