

Low cost flexible circuits and systems which can be printed on anything and placed anywhere

- Organic semiconductors are used instead of silicon.
- Global market predicted for 2015: 25 billion €.

## Motivation

- Need for better materials for photovoltaic solar cells (OPVs), non volatile memories, field effect transistors, light emitting devices (e.g. OLEDs).
- Further miniaturization towards devices at the molecular level (e.g. molecular wires and diodes).

## The Group

### Publications 2007-2011:

- 1 book (Computational Quantum Chemistry).
- 53 papers in journals (ISIS).
- 38 papers in conference proceedings.

### Theses supervision 2007-2011:

- PhD Theses:
  - Finished in the period: 3; Running: 6.
- Msc Theses:
  - Finished in the period: 8; Running: 3.

Group Members: 5 PhDs permanent staff; 4 postdocs; 6 PhD students; 1 Msc Researcher; 3 Msc students.



From left to right: Tânia Braz, Luís Alcácer, Rui Henriques, Ana Pereira, Ana Bragança, Rita Rodrigues, Ana Coelho, Ana Charas, Rui Meira, Joana Farinhas, Quirina Ferreira, Sofia Martins, Luísa Mendonça, Jorge Morgado, Graça Brotas.

## Main Lab Infrastructures and Equipment

- Glove box with fabrication and characterisation facilities.
- Scanning Tunneling/Atomic Force Microscope (STM/AFM).
- Inkjet printer for organic electronics.
- Testing systems for OPVs, OFETs, OLEDs and Memories.
- Ion Beam Assisted Deposition system (IBAD).
- Laminar flow workstations.
- Materials preparation laboratory.

## Current Research Topics

- Organic photovoltaics (OPVs).
- Organic non-volatile memories.
- Biocellulose for Printed Organic Electronics.
- Unimolecular devices (e.g. molecular wires).
- Organic/polymeric light-emitting diodes (OLEDs/PLEDs).
- Conductive films of donor-acceptor compounds electrochemically grown.
- Molecular conductors with conductivity and spin-transitions.

## Running projects:

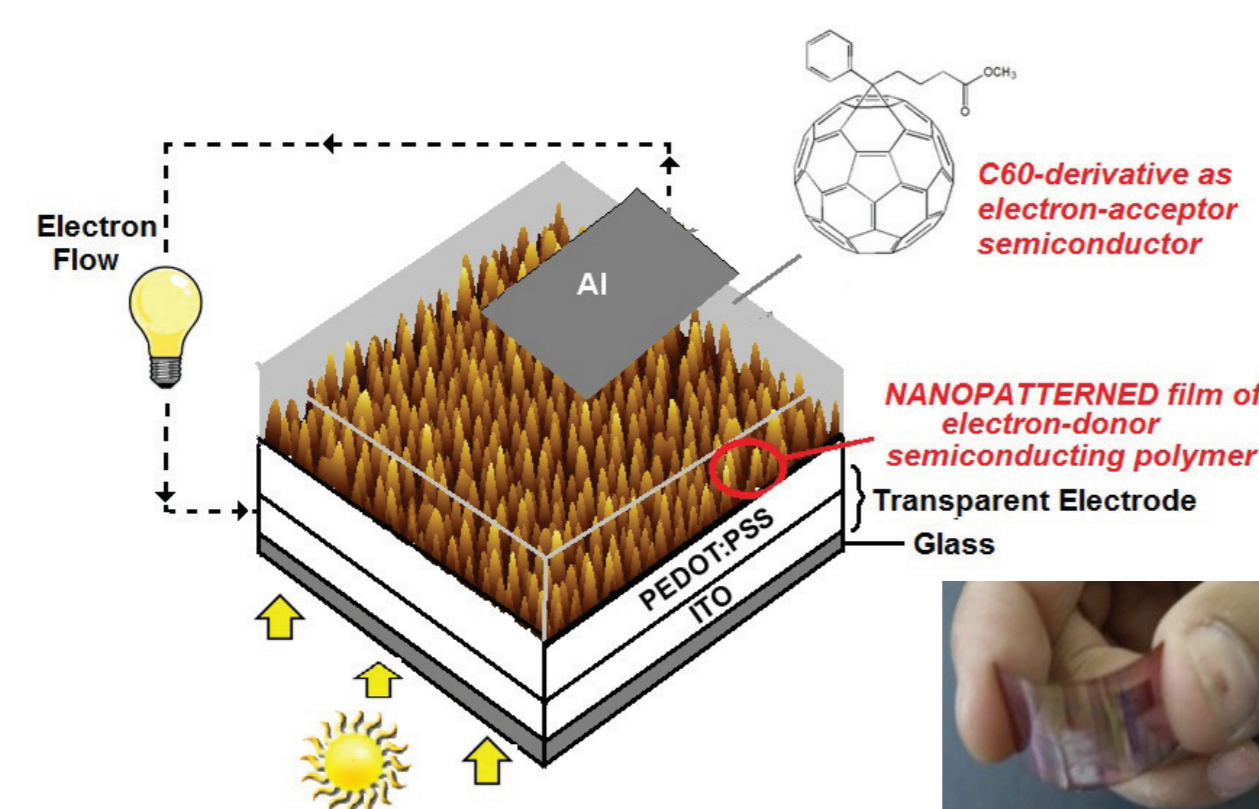
1. NOVO: "Non volatile polymer memories for flexible electronics"; FCT. End: 01-12-2014.
2. BC: "Biocellulose for Printed Organic Electronics"; FCT/PTDC. End: 01-02-2013.
3. NANOPEPS: "Micro- and Nanopatterning of cross-linkable electro-active polymers by spin-coating"; FCT/PTDC. End: 01-12-2013.
4. NHyMat: "SolarNHyMat-Nanostructured Hybrid Materials for Solar Cells"; FCT/PTDC. End: 01-12-2012.
5. MCLEDs: "New Luminescent Metal Complexes for Light-Emitting Diodes"; FCT/PTDC. End: 1/2/2012.
6. Dendrímeros: "Just in Time Dendrimers"; FCT/PTDC. End: 01-06-2012.

## Main International Collaborations

- Sir Richard Friend, Jenny Clark, Cavendish Laboratory, U. Cambridge.
- Donal Bradley, Imperial College, London.
- Dago de Leeuw, Philips - Eindhoven.
- Franco Cacialli, U. College London.
- David Lidzey, U. Sheffield.
- Andy Monkman, U. Durham.
- Ulrich Scherff, U. Wuppertal.
- Guglielmo Lanzani, IIT and Politecnico di Milano.
- Sigurd Schrader, U. Wildau.
- David Ginger, U. Washington
- Larry Lüer, Juan Cabanillas-Gonzalez, Instituto Madrileño de Estudios Avanzados (IMDEA), Madrid
- James Brooks - National High Magnetic Field Laboratory, Florida, USA.

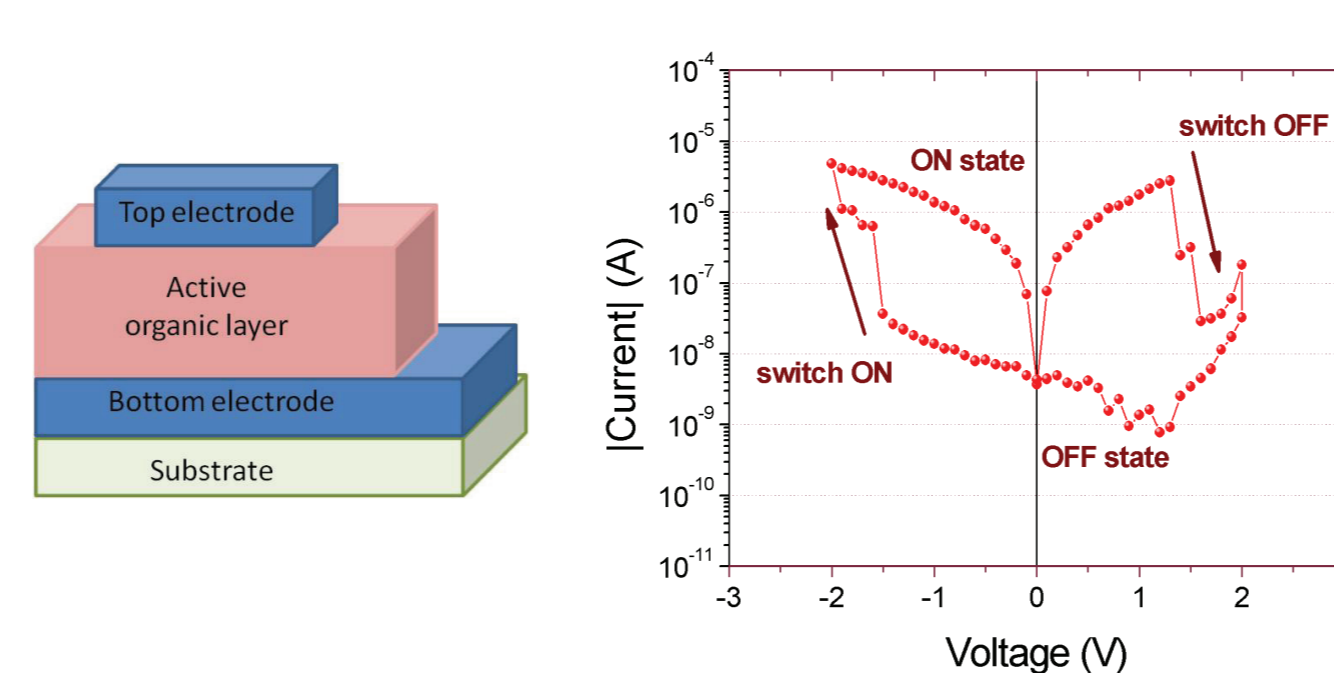
## Devices

### Organic Photovoltaic Solar Cells (OPVs)



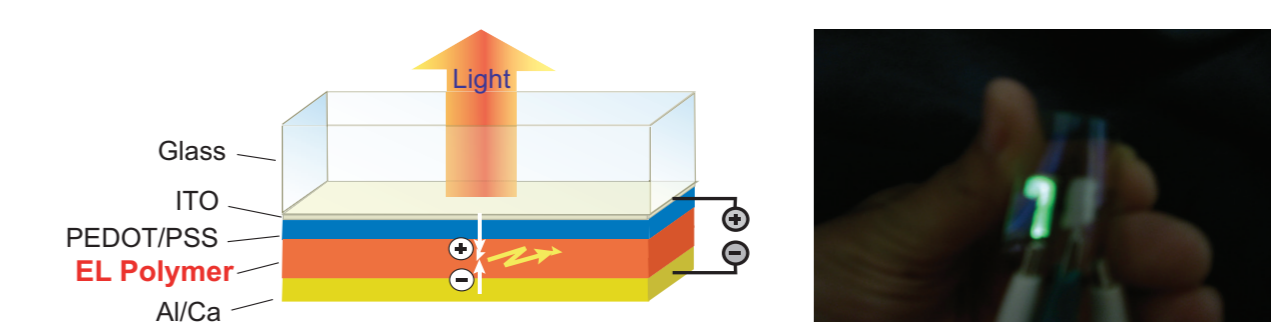
Organic Solar Cell with nanostructured interface

### Organic Non Volatile Memories



Schematics (ITO/Rose Bengal/Al); I-V characteristic.

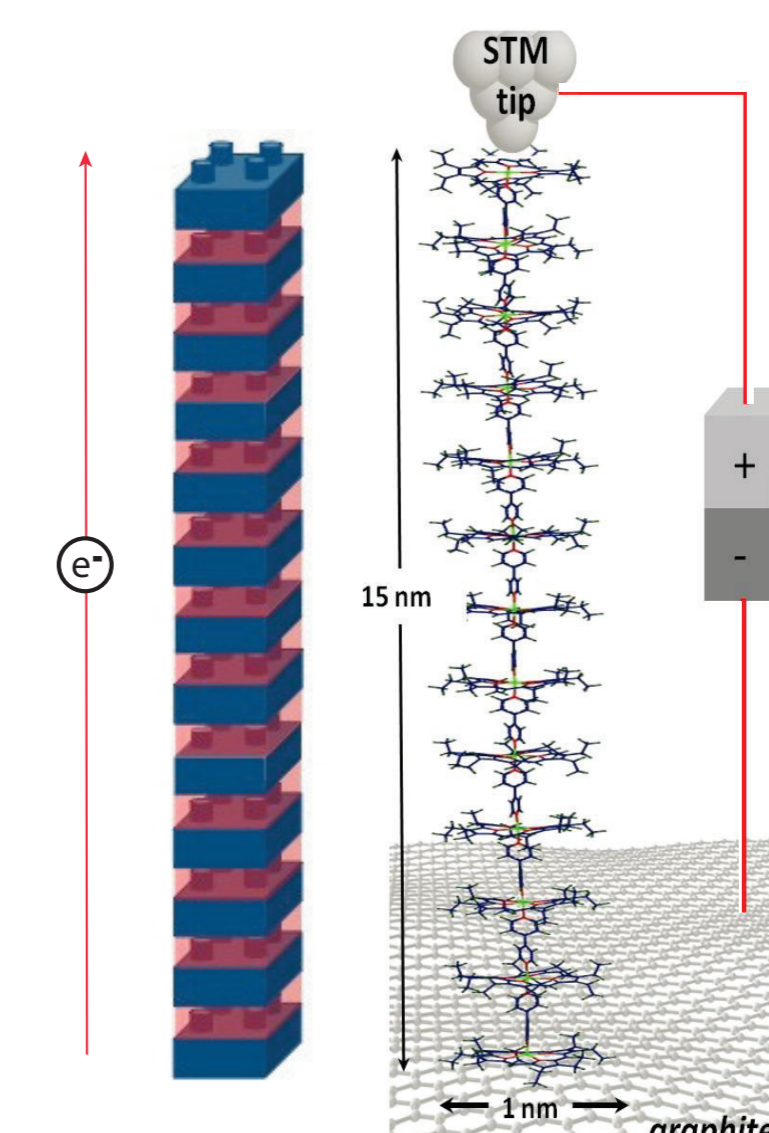
### Polymer Light Emitting Diodes (PLEDs)



OLED schematics and device.

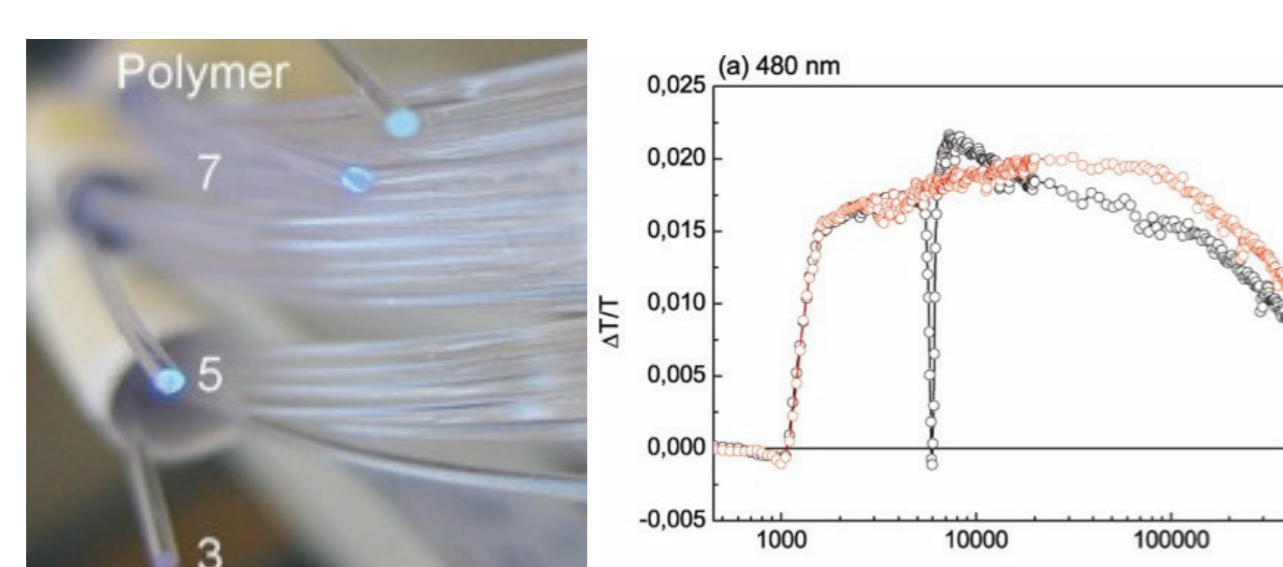
### Future Electronics Will Be Molecular

Manipulation of molecules to fabricate nanodevices



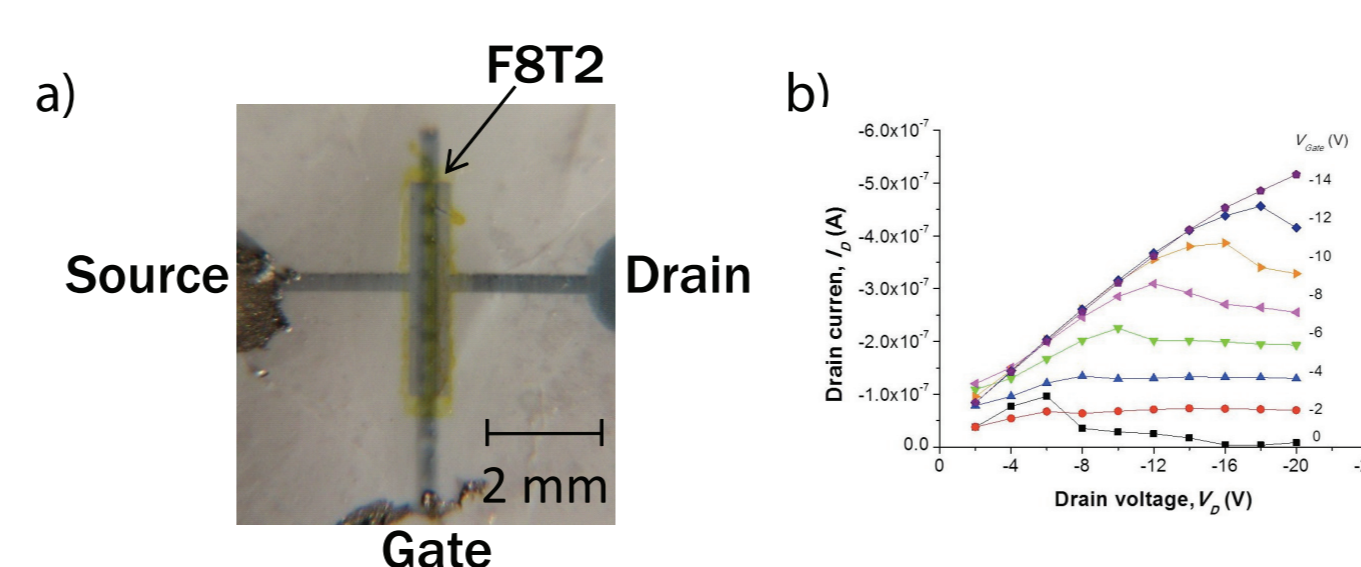
Conducting molecular wire with 25 molecules arranged as in a LEGO.

### Plastic Optical Fibers (POFs)



Fibers and optical switching in the copolymer.

### Printed Field Effect Transistors (OFETs)



Printed OFET on biocellulose: device; I-V characteristics.