

# Materials for Electronics, Optoelectronics and Nanotechnologies

Team responsible: Prof. Rodrigo Martins



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## Technicians

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## Processing Technologies

### Solution processing

Ink-jet and screen printing, spray-pyrolysis, spin-coating, for sol-gel, hydrothermal and combustion routes. Oxide semiconductors, dielectrics and electrochromics

### Physical vapor deposition

DC and RF magnetron (co-)sputtering, e-beam and thermal evaporation. Oxides, metals and alloys, multilayers, nanocomposites

### Chemical vapor deposition

PECVD and hot-wire PECVD for amorphous/micro/poly/nanocrystalline/polymorphous silicon and alloys, doped/undoped films. Parylene coating. Electrospinning for nanofibers.

### Patterning/Etching

Reactive ion etching with inductively coupled plasma (RIE-ICP) and optical mask aligners for device fabrication with resolution  $\geq 1 \mu\text{m}$

### Post-deposition/surface treatments

Rapid thermal annealing (RTA), microwave, UV-Ozone, plasma, laser, furnaces



Microelectronic clean rooms

## Scientific areas

Bio/Paper batteries

Bio/Nano/Paper electronics

Functional Nanoparticles

Nano/Chromogenics

Microfluidics/Lab-on-Paper

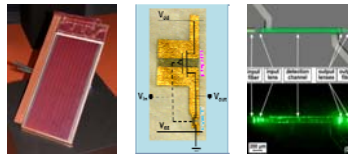
Plasmonics

Solar cells

Thermoelectrics

Transparent Conductive Materials

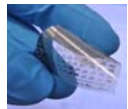
Transparent Electronics



Solar cells on ceramic tiles

Paper-ICs CMOS

Microfluidics



Transparent/Flexible Electronics



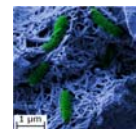
Lab-on-Paper



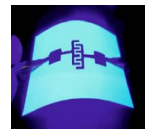
Paper transistor



Paper batteries



Electrochemically bacteria



UV paper-based sensor

## Characterization tools



SEM-FIB (Zeiss Auriga)  
Confocal microscope (Zeiss LSM700)  
Correlative microscopy SEM-Confocal (Zeiss)  
AFM (Asylum MFP-30)  
X-ray diffraction (Panalytical X'Pert PRO)  
Profilometers (Sloan Dektak Ambios)  
Contact angle system (Dataphysics OCA)  
TG-DSC-DTA (Netzsch STA409 F3)  
FTIR spectrophotometer (NICOLET 8700)  
UV-VIS-IR spectrophotometers (SHIMADZU UV3100, PerkinElmer Lambda 950)  
Spectroscopic ellipsometer (JDSU JY20E UVISSEL)  
Fluorescence spectrophotometer (PerkinElmer LS55)  
Dynamic Light Scattering (AvidNano 3500)  
Cytogenic probe stations (Janis ST-500 and BIORAD)  
Light shielded  $\mu\text{m}$  microprobe station (Cascade M150)  
Semiconductor parameter analysers (Agilent 4155C and Keithley 4200SCS)  
Kelvin probe (KP Technology)  
Hall effect (BIORAD HL5500PC)  
Four Point Probe (JANDEL)  
LCR meter (Agilent 4280A)  
Impedance analyser (Agilent 4290A)  
Sun simulator (SPIRE 240A, Scientech UNITE)  
Spectral response measurement (home-made)

## Running Projects



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## Recent publications

"Transparent Electronics: From Materials to Devices", P. Barquinha, R. Martins, L. Pereira, E. Fortunato, Wiley, 2012, ISBN 978-0-470-68373-6.

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