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OPTOELECTRONICS AND PHOTONICS GROUP

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The ISMAC-CNR Optoelectronics and Photonics Group has a long-standing tradition in the field of polyconjugated materials for electronics and photonics. The research in the last decade has been mainly focused in the design and development of polymeric advanced functional materials for applications in electronics, optoelectronics, photonics, energy storage, and sensors. The group has an interdisciplinary character with main expertise in macromolecular chemistry, structural chemistry, photophysucs and electronic devices. The core activities of the group are the following :

- design and synthesis of conjugated polymers
- preparation of functional materials by chemical tailoring and supramolecular organisation.
- structural and morphological characterisation
- vibrational, optical and photoexcitation spectroscopies
- device assembling and characterisation

Currently, our research is devoted to the design of conjugated polymers and oligomers to use as active components in devices like field effect transistors, solar cells, light emitting diodes, micro-systems for telecommunication.
Our interest is to design materials with tailored properties like: n- or p-type or ambipolar electric transport, emission, photoconduction, optical gap and redox properties, third order optic non linearity.
Special care is devoted to the processability of the materials and to their supramolecular organization, to attain the 3D arrangement necessary for the application. We study new materials with controlled morphology like block copolymers with phase nanosegregation, self-assembled in micro- or nanometric patterns useful as mould for soft-lithography. Simple and complex supramolecular structures are prepared (thin films, heterostructures and multilayers, organic-organic and organic-inorganic nanosegregated composite materials, nanowires) using different techniques (spin coating and evaporation from solution; high vacuum evaporation; Langmuir-Blodgett deposition; electrospinning; self-assembly; soft lithography; mechanical orientations).
The group has a long-standing tradition in studying the photophysical properties of conjugated materials for applications in optoelectronics. The research interests range within the following topics: electron-phonon coupling of conjugated materials; role of molecular structure and supramolecular organisation on the photoexcitations of conjugated materials; energy transfer processes in organic and organic-inorganic nanostructures; photo- and doped-induced charge transfer; devices physics of organic diodes: solar cells, oLEDs and memory devices.
The following tools are available to study the relation between structure and properties of the materials.: a) a variety of macromolecular characterisations techniques: NMR, GC, DSC, SEC, UV-Vis-Nir absorption spectrometer, FT-IR, cyclic voltammetry; b) structural and morphological characterisation techniques: powder and low angle X-rays diffractometers and AFM. Optical spectroscopies: Raman spectroscopy with excitation wavelengths ranging from the UV to the NIR, in-situ electrochemistry spectroscopies (Raman and UV-Vis-Nir absorption), FT-IR photoinduced absorption, cw modulated photoinduced absorption, electro-absorption, photoconductive action spectroscopy, photo- and electro-luminescence, confocal microscopy equipped with luminescence spectral probes. Moreover the group possesses the know how and the facilities to assemble and test prototype organic solar cells and oLEDs.