

Consiglio Nazionale delle Ricerche, Istituto per lo Studio delle Macromolecole (ISMAC-CNR)
Milano, Italy, www.ismac.cnr.it

ORGANIC SOLAR CELLS ACTIVITIES

Marinella Catellani, Darek Kotowski, Erika Kozma, Silvia Luzzati

ISMAC Optoelectronics and Photonics Group has a ten year experience in the field of organic solar cells. The aim of our work is to develop new polymer-based active materials with tailored properties for bulk heterojunction solar cells. We have a multidisciplinary approach and our studies range from the synthesis of the materials to the assembling and testing of prototype devices.

The research activities are the following:

- a) Synthesis of new donor/acceptor polymers. We prepare donor conjugated polymers with tailored optical and redox properties, p-type and n-type polymers to use as active components in bulk heterojunction solar cells.
- b) Structural and electronic characterisation of polymeric materials by IR, Raman spectroscopy, optical absorption, FTIR-photoinduced absorption, luminescence and electrochemistry. Special attention is devoted to study p-type and n-type properties of conjugated polymers upon probing the spectral signatures of positive and negative charges induced by chemical doping or by photo-excitation.
- c) Study of charge photo-generation in donor/acceptor photoactive materials by steady state photo-induced absorption.
- d) Photoactive film morphology optimization. Our actual interest is to design the blend morphology in donor conjugated polymers/perylene diimide acceptors systems.
- e) Solar cell device assembly and photovoltaic characterization.

The well established experience of our team in the development of new materials for photovoltaic devices has led to fruitful collaborations with several European groups working in this field. In the last seven years we have been Partners in the following E.U. projects related to polymeric solar cells: RTN EUROMAP(2000-2004); RTN SOLARNTYPE (2006-2010); CA ORGAPVNET (2006-2009). The solar cell activities has been also sponsored by national research projects: PF MISTA FREMO (1997-2000), FIRB SINERGY (2005-2008); and by regional projects : Fondazione Cariplo TESEO (2003-2005), PROTEO (2006-2007), DANAE (2008-2009).

Selected references

“Dithienothiophene based polymer as electron donor in plastic solar cells”
S. Millefiorini, E. Kozma, M. Catellani, S. Luzzati, *Thin Solid Films*, in press

“Thermal characterization and annealing effects of polythiophene/fullerene photoactive layers for solar cells.”
R. Cugola, U. Giovanella, P. Di Gianvincenzo, F. Bertini, M. Catellani, S. Luzzati. *Thin Solid Film* 489, 511-512, (2006)

“Long-Lived Photoinduced Charges in Donor-Acceptor Anthraquinone-Substituted Thiophene Copolymers.”
S. Luzzati, M. Scharber, M. Catellani, F. Giacalone, J. L. Segura, N. Martin, H. Neugebauer, N. S. Sariciftci
J. Phys. Chem. B 110, 5351-5358 (2006)

M. Catellani, S. Luzzati, N.O. Lupsac, R. Mendichi, R. Consonni, F. Giacalone, J. L. Segura, N. Martin,
“Donor-acceptor Polythiophene copolymers with tunable acceptor content for photoelectric conversion devices.”, *J. Mater. Chem.* 14, 67-74 (2004)

E. Ehrenfreund, A. Cravino, H. Neugebauer, N.S. Sariciftci, S. Luzzati, M. Catellani, “Even parity states in small band gap -conjugated polymers: polydithienothiophenes.”, *Chem. Phys. Lett.*, 394, 132 (2004)

“New polythiophenes bearing electron acceptor phthalocyanine chromophores”, M.V. Martínez-Díaz, S. Esperanza, A. de la Escosura, M. Catellani, S. Yunus, S. Luzzati, T. Torres, *Tetrahedron Lett.*, 44, 8475 (2003)

“Positive and Negative Charge Carriers in Doped or Photoexcited Polydithienothiophenes: a Comparative Study Using Raman, Infrared and Electron Spin Resonance Spectroscopy”, Antonio Cravino, Helmut Neugebauer, Silvia Luzzati, Marinella Catellani, Andreas Petr, Lothar Dunsch, and N. Serdar Sariciftci, *J. Phys. Chem B*, 106, 3583 (2002).

