

**Presentation of IPREM**  
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Since 2003, researchers from the group "conjugated polymers" are mainly chemists who are involved in the elaboration of polymers based on polythiophenes as donor systems for organic solar cells. The first activity was based on the preparation of various poly(3-hexylthiophene)s (P3HT) with definite physical characteristics (molecular weights, polydispersity index) *via* the GRIM method.<sup>1</sup> Then, the relationship between these physical characteristics and photovoltaic performances of heterojunction solar cells with PCBM was explored. The results pointed out the strong influence of both molecular weights and polydispersity.<sup>2,3</sup> This work was released in the framework of the project CSPVP funded by the French agency ADEME, directed by CEA Saclay. Meantime, copolymers based on P3HT sequences alternated with fullerene were synthesised. Polythiophene derivatives exhibiting an absorption extended towards the infrared were prepared by varying the nature of the lateral chain and more precisely by introducing phenyl and phenoxy groups.<sup>4,5</sup> These materials were tested at INES-LCS (France) in the framework of the project NANORGYSOL funded by the French agency of research ANR. With these new materials conversion yields of 1.5 % were achieved. Based on these results, rod-rod block copolymers based on P3HT and polythiophene substituted by phenyl groups are synthesised with the aim to combine the behaviour of crystallisation of the former with the improved absorption of the latter.<sup>6</sup> A route to donor/acceptor copolymers is also studied within a bi-lateral project with Great-Britain (ALLIANCE, 2 years) funded by Egide.

The group also works on intrinsic conducting composite to carry out new ways of composite synthesis either in aqueous phase, in bulk or in organic solvents.<sup>7,8</sup> The materials are processed for conducting coating (water-based paints for house needs, sensors...). Pre-industrial developments are supported by ANVAR and a tri-lateral project with Czech Republic and Russia (ECONET, 2 years) is funded by Egide. In the field of PV, we focus on the development of conducting organic layer as flexible electrodes.

Techniques currently used by the group to characterise polymers are spectroscopic techniques as NMR, UV-visible absorption, fluorescence, gel permeation chromatography, conductivity measurements, thermal analyses, etc. Besides, a collaboration with the team devoted to Chemistry and Physics of IPREM, permits the surface characterisation of thin films by AFM (study of morphologies of photoactive layer), by XPS/UPS spectroscopies and theoretical calculations of polymer structures (determination of optical properties, etc.).

- 1) **INVITED ARTICLE:** EXTREMELY REGIOREGULAR POLY(3-ALKYLTHIOPHENE)S FROM SIMPLIFIED CHAIN-GROWTH GRIGNARD METATHESIS POLYMERISATIONS AND THE MODIFICATION OF THEIR CHAIN-ENDS, R.C. Hiorns, A. Khoukh, B. Gourdet, C. Dagron-Lartigau, *Polym. Int.* 2006, 55, 608-620
- 2) INFLUENCE OF MOLECULAR WEIGHTS, POLYDISPERSITIES AND ALKYL CHAIN INTERDIGITATION OF POLY(3-HEXYLTHIOPHENE) AND POLY(3-BUTYLTHIOPHENE) ON BULK HETEROJUNCTION SOLAR CELL EFFICIENCIES, R.C. Hiorns, R. de Bettignies, J. Leroy, M. Firon, C. Sentein, A. Khoukh, C. Dagron-Lartigau, *Adv. Funct. Mater.* 2006, 16, 2263-2273
- 3) THE INFLUENCE OF MOLECULAR WEIGHT DISTRIBUTION ON THE OPTIMAL THERMAL TREATMENT OF POLY(3-HEXYLTHIOPHENE)S BASED BULK HETEROJUNCTION PHOTOVOLTAIC CELLS, R.C. Hiorns, R. de Bettignies, J. Leroy, S. Bailly, M. Firon, C. Sentein, H. Preud'homme, C. Dagron-Lartigau, *Eur. Phys. J., Appl. Phys.* 2006, 36, 295-300
- 4) SYNTHESIS AND CHARACTERIZATION OF HIGH MOLECULAR WEIGHT AND REGIOREGULAR POLY[3-(4-OCTYLPHENYL)THIOPHENE] FOR BULK HETEROJUNCTION PHOTOVOLTAIC CELLS, F. Ouhib, R.C. Hiorns, S. Bailly, R. de Bettignies, A. Khoukh, H. Preud'homme, J. Desbrières, C. Dagron-Lartigau, *Eur. Phys. J., Appl. Phys.* 2007 37, 343-346
- 5) REGIOREGULAR PHENYL AND PHENOXY SUBSTITUTED POLYTHIOPHENES FOR BULK HETEROJUNCTION SOLAR CELLS, F. Ouhib, G. Dupuis, R.C. Hiorns, A. Khoukh, S. Bailly, H. Martinez, R. de Bettignies, J. Desbrières, C. Dagron-Lartigau, *Macromol. Symp.* 2007 In press
- 6) PHOTOVOLTAIC CELLS BASED ON POLYTHIOPHENES CARRYING LATERAL PHENYL GROUPS, F. Ouhib, R.C. Hiorns, R. de Bettignies, S. Bailly, J. Desbrières, C. Dagron-Lartigau, *Thin Solid Films* 2007, In press, Corrected proof available on line 15 december 2007
- 7) **MINI REVIEW:** OVERVIEW OF THE PREPARATION OF PURE POLYANILINE AND CONDUCTIVE COMPOSITES IN DISPERSED MEDIA AND BY THERMAL PROCESSES: FROM LABORATORY TO SEMI-INDUSTRIAL SCALE., N. Kohut-Svelko, F. Dinant, S. Magana, G. Clisson, J. François, C. Dagron-Lartigau, S. Reynaud, *Polym. Int.*, 2006, 55, 1184-1190.
- 8) STUDY OF NANOCOMPOSITE BASED ON A CONDUCTING POLYMER: POLYANILINE, N. Kohut-Svelko, S. Reynaud, R. Dedryvère, H. Martinez, D. Gonbeau, J. François, *Langmuir*, 2005, 21, 1575-1583