MCP

MCP division of IMEC has a long-standing tradition in the field of solar cells. The main focus was in the past on crystalline Si solar cells. Within bulk crystalline Si solar cells and thin-film crystalline Si solar cells, the group has a proven track record consisting of high-efficiencies obtained by high-efficiency laboratory-type processes and more industrial processes using screenprinting.

MCP division possesses a large instrumentarium to realize organic devices of different kinds: Organic LEDs, organic thin-film transistors, biosensors and solar cells. Most relevant in the frame of this project is the organic evaporation system consisting of three chambers built up around a central loadlock connected to a N_2-box. 2 chambers with a total of 9 sources are used for the evaporation (or coevaporation) of organic small molecule materials whereas the third source, equipped with 4 sources is used for the metal evaporation. Besides the spincoaters also a doctor-blade system and a screenprinter are available. The morphology of the devices can be analysed by SEM, AFM and XRD, whereas the opto-electrical characteristics can be analysed by HP I-V analysers, a system for AM1.5 illumination, a spectral response measurement unit and an electro-absorption set-up.

IMOMEC

IMEC/IMOMEC "Organic and Polymer group" uses its knowledge, know-how and scientific infrastructure to develop new advanced material systems. It puts its knowledge, know-how and scientific infrastructure to the disposal of companies. It wishes to combine creative science with modern management. The core competencies of IMEC/IMOMEC/Organic and Polymer Chemistry group are:

- Design, synthesis and study of advanced material systems for electronic, optical and electro- optical applications: conjugated polymers, oligomers, low band gap polymers.

  Since 2001, this field was broadened to include also materials for use in bioelectronics (biosensors) and nanotechnology (self-assembling system).

  IMO/IMOMEC performs research in the field of the synthesis and characterization of functional polymers with new electrical conductive and/or special optical properties. Besides the study of novel synthetic methods for special monomers, new polymerization reactions, mechanisms of polymerization reactions, also modifications of existing polymerization pathways are studied. In this area, attention is also paid to the theoretical basis related to these material systems, in order to get an insight into the underlying structure-property relations. The goal is to achieve a rational material design. Work aims on the development of new materials, fundamentals and new concepts in polymer technology. The group has many years of practice in organic synthesis and polymer synthesis. This experience developed over the years in the field of electro-optical devices is used to develop further our research in the field of fundamental and applied science of plastic electronics.
- Development and synthesis of small molecules and polymers for "self-assembling" structures using NLO, liquid crystals…
- Characterization of polymeric systems. Gel Permeation Chromatography and NMR-Spectroscopy. The specific interests within these domains relate to the synthesis and characterization of functional polymers and the study of structure and dynamics of polymer systems via liquid-state and solid-state NMR.
- Synthesis and study of thin film systems.
- The group has a strong international reputation on the use of NMR in the global characterization of polymer systems: besides structural characterization in the liquid as well as in the solid state (almost all NMR sensitive nuclei), attention is strongly focused on the study of the nanometer scale molecular chain dynamics and miscibility (phase separation) by solid state NMR relaxometry in a non-invasive and non-destructive way. These studies can be performed via the sensitive proton nucleus (wideline NMR) as well as via the chemical shift selective carbon nuclei (CP/MAS NMR) or localised by MRI. Although even high resolution MRI only allows an inplane pixel resolution of about 15x15 micrometer, relaxometry offers

the possibility to study the molecular chain dynamics and proton spin density on the nanometer scale. MRI can, as an example, used in the study of polymer materials under mechanical load in the magnet by means of a dedicated stretching device.

NMR equipment available: Varian Inova 400 MHz and 300 MHz spectrometer, equipped for liquid state, solid state (wideline and CP/MAS) and MRI. Varian Unity 200 MHz spectrometer, equipped for liquid and up-to-date CP/MAS NMR (TLT probe design).

- The group is also involved in the development of specific analytical strategies for the study of advanced material systems with a special focus on polymers. The main features are:
  1. Chemical and physico-chemical characterization of materials as a tool for the study of the structure/property relationship for the evaluation of the performance of a material during processing and for specific applications.
  2. Failure behaviour-troubleshooting.
     Thermo-oxidation, chemical degradation, durability
  3. Use of hyphenated analytical techniques

     Several hyphenated technique are available (TGA-MS, TGA - FT-IR, FT-IR microscopy, GC- MS, headspace GC-MS, pyrolysis GC-MS , thermal desorption GC-MS, DIP-MS, TGA-TD-GC-MS) for online and off-line measurements under different thermal and atmospheric conditions.

Modern equipment with emphasis on NDT and hyphenated techniques are available:

Elemental analysis (AAS, ICP-OES, XRF, FIA).
Chromatography (GC, HPLC, IC, GPC).
Spectroscopy (UV-VIS, FT-IR, FT-Raman, Fluorescence, NMR and MS).
Thermal analysis (MDSC, TMA, DTA, TGA, DMA, rheology, Hires TGA).
Advanced NMR techniques(solid state NMR, liquid , MRI, relaxometry).
Potentiometry and cyclic voltammetry.
Particle size analysis.
Mass spectroscopy (EI and CI, MS/MS, Fab-MS).

- IMO/IMOMEC has also a large instrumentarium to realize organic devices of different kinds: Organic LEDs, organic thin-film transistors, biosensors and solar cells. The morphology of the devices can be analysed by SEM, TEM, AFM and XRD, the opto-electrical characteristics can be also analysed in house.

The team is strongly interdisciplinary (chemists, material physicist, engineers, biomedical researchers). About 70 % of the research funding at IMO/IMOMEC comes from applied research projects, mainly in collaboration with industrial partners, and 30 % from funding for fundamental research by the Flemish government and the university.

The group has a long tradition in contract research and scientific support towards industry under flexible but well-defined conditions. A permanent staff of qualified technicians and scientists are involved in this multidisciplinary research. Long term, multidisciplinary projects as well as problems requiring a quick response can be handled by the team. Confidentiality is guaranteed by a secrecy agreement.

Currently, the focus for fundamental research is on the synthesis of multifunctional conjugated polymers and/or organic semiconductor materials for use in electronics (LEDS, Organic Transistors, Organic Solar Cells..) and “self-assembling” conjugated polymers and molecules for future use in bioelectronic devices (mainly biosensors).