Surface characterization and treatment

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Research Field and Subjects

The research activities concern the physical chemistry of solid surfaces and interfaces. The objective is to develop surface treatments and modifications in order to provide new surface properties in view of specific applications in materials science.

To reach this goal, our approach is based on a control of the surface atomic and molecular composition and structure. The first step required in this way is to be able to characterize the solid surfaces in terms of chemical and functional composition and structure at the nanometer scale. For that purpose, our main expertise has been the development and the use of surface analytical methods based on the ion-solid interaction (Secondary Ion Mass Spectrometry and Ion Scattering Spectrometry - ISS and RBS), in combination with other surface techniques such as AES, XPS, the Near Field Microscopies (AFM, STM) and the Electron Microscopies (SEM, TEM).

In particular, for more than ten years, we have been contributing to the development of the static SIMS technique for the molecular characterization of surfaces, with a special emphasis on organic materials such as polymers. Using classical molecular dynamics, important efforts have also been devoted at modeling the interaction of ions with various surfaces (metal, organic layers, bulk organic samples).

The investigated surface properties are adhesion, biocompatibility, (bio)sensing, specific catalytic activity and gas/molecule permeability. The methods used to modify the surface are based on chemical and physical treatments: plasma treatments, ion beam irradiation, chemical grafting, thin (organic/metallic) layer adsorption. A strong expertise has been gained in the metallization of polymers (interface formation, metal layer growth modes, metal diffusion into polymer bulk). A new direction concerns the elaboration and characterization of (bio)sensors, from the synthesis and grafting of conducting polymers to the evaluation of the final device.

The group has a long experience of collaboration with partners from university and industry research centers.

Products and Services

Service provided to companies for practical surface characterization and imaging.

Main Equipment

Equipments for surface characterization:
- Secondary Ion Mass Spectrometry
  - quadrupole mass spectrometer (static and dynamic SIMS).
  - static imaging time-of-flight mass spectrometer (ToF-SIMS).
- Rutherford Backscattering Spectrometry (using a VDG accelerator) RBS.
- Ion Scattering Spectrometry (ISS).
- Scanning Auger Microprobe (AES–SAM).
- Access to AFM, STM, XPS-ESCA, SEM, TEM, XRD, Ellipsometry, static and dynamic contact angles, IR, Raman.

Equipments for surface modification:
- low-pressure plasma chamber.
- metallization chamber.
- ion sources for surface treatment.

Representative References

- P.A. GOLLIER, P. BERTRAND. Cyclic oligomer segregation at metallized Polyethylene


Partnership

Gabriel Lippmann Public Research Center, Luxembourg.
Pennsylvania State University, USA.
IMEC, Leuven, Belgium.
NEUROTECH, Louvain-la-Neuve, Belgium.

KEY WORDS FOR R&D
biomaterials
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ion spectrometry
metallization
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Patents

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