# POLYMERS CHARACTERIZATION

## MECHANICAL RESISTANCE

Evaluation of the **mechanical resistance** of the materials subjected to tension or under compression. Ability to evaluate the mechanical properties depending of the temperature.

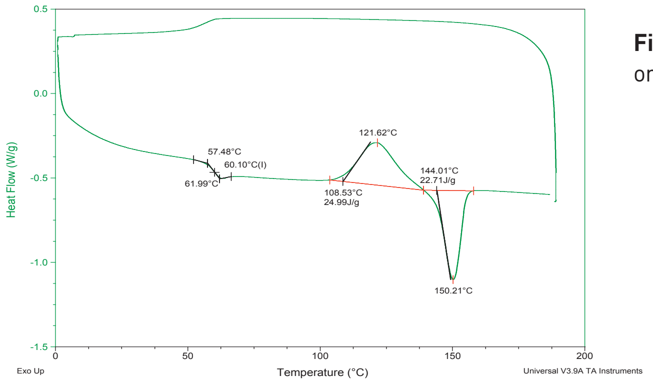
Evaluation of the surface hardness of materials: **hardness** Shore A (soft materials) and Shore B (rigid materials).

## THERMAL AND THERMOMECHANICAL BEHAVIOR

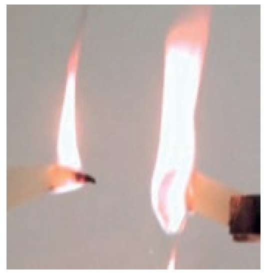
Determination of the nature of the degradation products : deformulation, toxicity, ... by **thermogravimetric analysis (TGA)**. Ability to add Mass Spectrometry or InfraRed detector and to work under controlled atmosphere (helium, nitrogen, oxygen or air).

Determination of the polymers characteristic temperatures (glass transition (Tg), melting temperature (Tm), crystallization (Tc)) and the corresponding enthalpy by **differential scanning calorimetry (DSC)**. Measure of the crystallinity level, heat capacity, freezing point depression. Establishment of the phase diagram and control of the purity and quality of products.

*DSC curve of PLA*




Evaluation of the thermomechanical properties and determination of the Young's modulus regarding the temperature using **dynamic mechanical analysis (DMA).** Ability to work using different solicitation modes: tension, compression, flexion, shear.



**Fire reaction** and **rheology** testing, **permeability** to water or gases study, measure of the **resistivity** and **ageing** study.

# BIOCHEMICAL CHARACTERIZATION

Materia Nova also has at your disposal different **chromatography** techniques such as LC-MS, GC-MS, HPLC, FPLC and size exclusion chromatography.

MateriaNova

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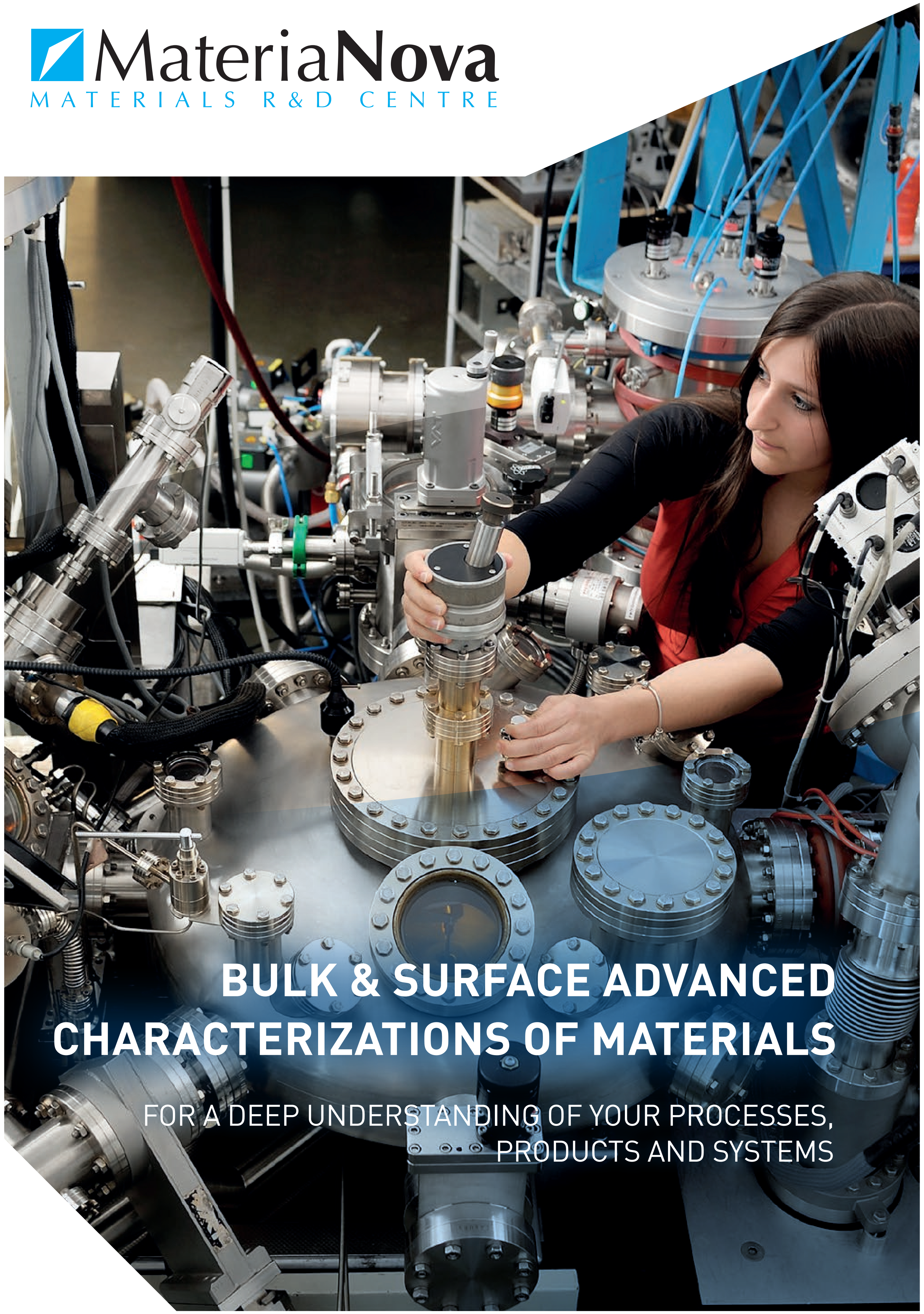
PLUS HAUT ET PLUS PROCHE
LE FONDS EUROPÉEN DE DÉVELOPPEMENT RÉGIONAL ET LA WALLONIE INVESTISSENT DANS VOTRE AVENIR
FEDER
UNION EUROPÉENNE
Wallonie

Design by ex nihilo

MateriaNova
MATERIALS R&D CENTRE



# BULK & SURFACE ADVANCED CHARACTERIZATIONS OF MATERIALS

FOR A DEEP UNDERSTANDING OF YOUR PROCESSES, PRODUCTS AND SYSTEMS

# SURFACE TREATMENTS EVALUATION

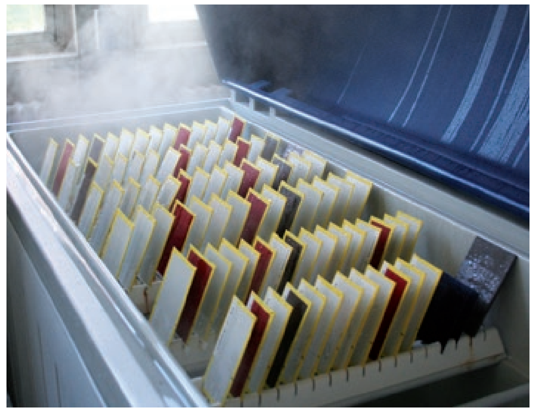
## STANDARDIZED TESTS

### ACCELERATED AGEING TESTS

- Corrosion test chambers (salt spray, cyclic tests,...)
- Climatic test chambers (RH/T° cycles,...)
- Kesternich chambers (humidity cabinet, $SO_2$, ozone,...)
- UV test chambers (QUV, Xenon)

### MECHANICAL RESISTANCE TESTS

- Scratch-test
- Bending test
- Impact resistance test
- Pull-off test

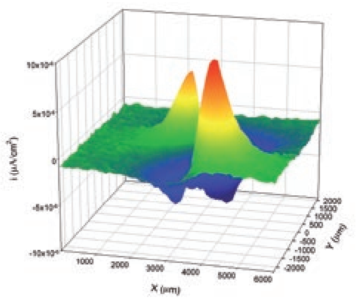


## ELECTROCHEMICAL CHARACTERIZATION METHODS

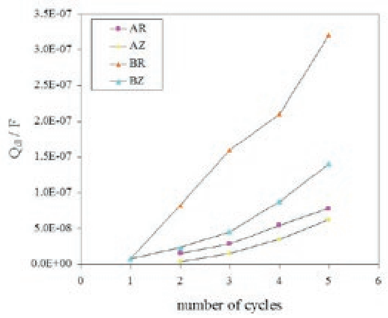
- **Characterization of protective coatings:** barrier properties, porosity, water permeability, delamination, filiform corrosion,...
- **Development of electrochemical methods** for the corrosion monitoring
- **Ac/dc/ac cycles:** combination of EIS and cathodic polarization to follow the evolution of a coated metal under cathodic delamination
- **Edge corrosion:** evaluation of the edge protection by performing electrochemical measurements on coated knive blades

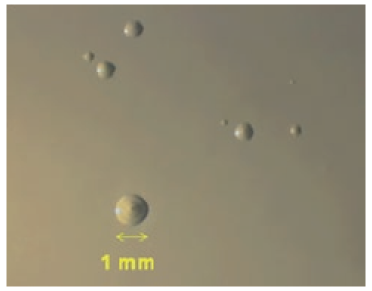
## EQUIPMENT

- **Potentiostats/galvanostats:** corrosion rates, pitting, polarization resistance, galvanic corrosion,...
- **Frequency analyzers:** Electrochemical Impedance Spectroscopy (EIS)
- **Local electrochemical techniques:** use of the scanning vibrating electrode technique (SVET) to study local galvanic corrosion, pitting and evaluation of self-healing




*SVET map of coated galvanized steel*




*Evaluation of coating porosity and resistance to delamination using AC/DC electrochemical measurements*

# MATERIALS AND SURFACE CHARACTERIZATION

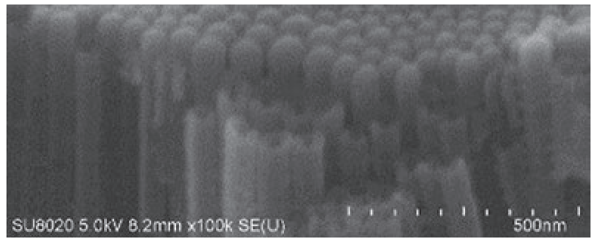
## MICROSCOPY

A **scanning electron microscope (SEM)** enables to visualize objects with magnification up to 300 000x and a resolution of 1 nm.

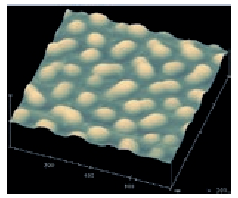
**Transmission electron microscopy (TEM)** gives information on sub-microstructure of composites including nanoparticles.

The **energy dispersive X-ray spectroscopy (EDX)** coupled with both SEM and TEM is used to localize and determine the chemical nature of elements in the sample.

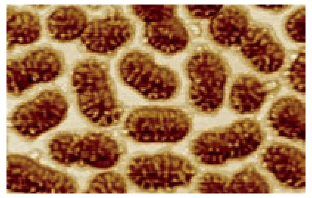
With the **atomic force microscopy (AFM)**, both topographical and phase images can be recorded simultaneously. Other properties (mechanical, electrical...) can be obtained at nanoscale level.




*SEM nanotube picture*



*AFM topography imaging*

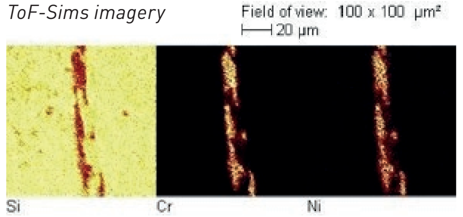


*AFM phase imaging*

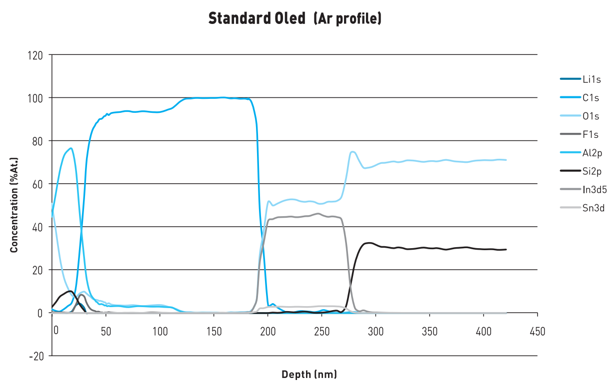
## SURFACE AND INTERFACE

**X-rays Photoemission (XPS) and Time-of-Flight Secondary Ion Mass (ToF-SIMS) spectroscopies** enable elementary chemical analysis of the topmost surfaces and interfaces. XPS also gives information on the elements chemical state (oxidation level,...) while ToF-SIMS can identify complex molecular compounds (including isotopic substitution) thanks to its high mass resolution.

*ToF-Sims imagery*




*XPS depth profile of an OLED layer on ITO substrate (C60 and Ar sputter gun)*



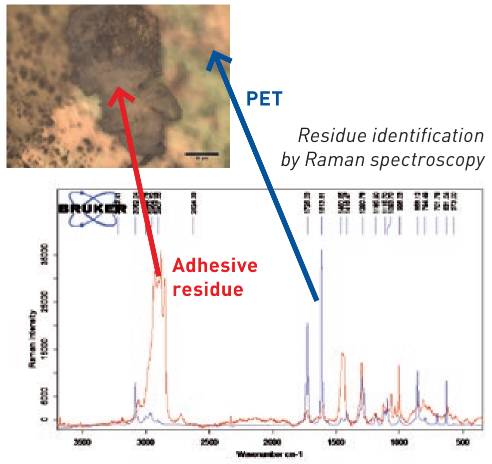

## OPTICAL SPECTROSCOPY

**Micro-Raman and Fourier Transformed Infrared (FTIR)** analysis enable to determine qualitatively functional groups in several materials (inorganic, polymers, contaminations ...).

Chemical mappings of surfaces are obtained with a spatial resolution of one micron.

**UV-visible-NIR spectrophotometry** is used to obtain the optical properties of bulk and coated substrate (absorbance, reflection or transmission mode).

The use of an integration sphere can determine the specular, diffuse and total reflectivity (e.g. for lighting and solar applications).




*Residue identification by Raman spectroscopy*

## ELECTRICAL ANALYSIS

4-probes Hall and Van der Pauw measurements give the (sheet) resistivity in the range of $10^{-5}$ to $10^{14}$ Ohm.cm. Moreover, the charge carriers density and mobility in thin layers of semi-conductors and metals can also be extracted at a temperature ranging from 80 K to 580 K.