Subject:	**SURFACE ANALISIS**
Semester:	**Spring**
ECTS credits:	**2.5**
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General objectives of knowledge:

- Knowing the fundaments of surface analysis techniques
- Making a correct evaluation of the resolution limits of each technique within the global context of characterization techniques.
- Knowing the fundaments of each technique, the equipment used and the information that each one of them gives, to be able to judge its applicability according to the specific problem to analyze.
- Knowing the nowadays developments and techniques in surface analysis
- Knowing the most prestigious international forums for research results diffusion.
  Knowing centres near to the university as well as important international centres.

Specific competences:

- Basic ability to use surface analysis tools.
- Knowledge of how to interpret information and recognize possible misinterpretations. Knowledge of how to extract quantitative information
- Judge the pertinence of using the various surface analyses for solving a specific problem, taking on account human and economic effort– expected results.
  Define characterization strategies according to the problem to solve and how complementary are they with other characterization techniques.

- Judge how complementary are the direct observations with the quantification and simulation tools that are adequate for a deep analysis of information.

Recommendations / Requirements

Recommended having elemental notions of crystallography and X-Ray diffraction

Recommended knowledge of optical fundaments.

CONTENTS:

Subject 1. Introduction to surface analysis techniques

Surface analysis: optical, structural, chemical and physical techniques for materials characterization and nanotechnology processes

Basic characteristics: Obtained information, spatial and depth resolution, sensitivity, specifications and requirements of the samples. Probe matter interaction.

Ability in characterization processes. (in-situ analysis, ex-situ analysis).

Subject 2. Optical techniques for analysis

- Reflectance. Transmittance, Infrared reflection absorption spectroscopy (IRRAS).
- Reflectance anisotropy spectroscopy (RAS), Spectroscopic ellipsometry (SE).
- Polarimetry.
- Mueller matrix ellipsometry, Rayleigh-Mie scattering ellipsometry.
- Raman Spectroscopy. Raman microprobe principles. Resonance studies.
- Surface analysis: "Surface Enhanced Raman Spectroscopy" SERES.
- Applications to nanostructures and nanomaterials: lenght effects of correlation.
- Luminescence: Photo and electroluminescence. Optical absorption: Excitation photoluminescence. Application to nanostructures and nanoparticles characterization.
- Surface analysis: TIRF.

Subject 3. Diffraction techniques

Crystalline structures characterization: X-ray diffraction (XRD). Neutron diffraction. Utilization of Synchrotron radiation "Energy Dispersive XRD". Nanograin effects: Identification of nanophases.

Subject 4. Physical- chemical techniques

Surface analysis: XPS (X-Ray Photoelectron Spectroscopy). UPS (Ultraviolet Photoelectron Spectroscopy) Auger electron spectrocopy. Auger nanoprobe. Depht analysis applications (depth profiling) SIMS: Secondary Ion Mass Spectroscopy. Nanometric resolution application by surface analysis: TOF-SIMS Usage of synchrotron radiation based techniques: EXAFS "Extended X-Ray Absorption Fine Structure".

Plan:

Lectures:	**12 Hours**
Laboratory Hours:	**20 Hours**
Independent work:	**12 Hours**
Study:	**25 Hours**

Practice: Laboratory Sessions

We considerate a total of 8 laboratory session of 2.5 hours each, with the students set in groups. These sessions will be performed basically in Cientific-Technic Services building of the Universidad de Barcelona. 4 of them will be dedicated to the introduction of the instruments. The other 4 will be complemented with exercises derivated form the practical experience and Hill be solved individually or in groups, and after, the results will be presented to the class.

Evaluation

Paper readings and essays on the usage of the techniques learnt. Making and presenting a memory of the experience.