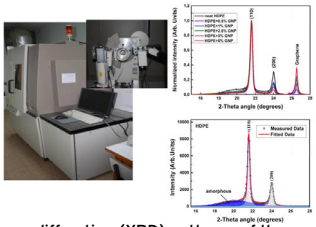
LABORATORY OF HIGH TECH MATERIALS

Short Description

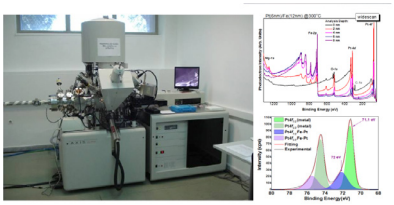
The goal of X-ray, FTIR Spectroscopy and Thermal Analysis Laboratory, located in the Department of Physics, is the research and the development of high-tech activities, the collaboration with research centers and academic institutions, and the organization of lectures and other scientific events. The research objectives of X.OP.Th. are: 1. Formation and synthesis of high-tech materials. 2. Structural materials characterization using X-ray methods. 3. Optical Properties and Spectroscopy. 4. Thermal analysis. 5. Morphological characterization and elemental analysis of materials and surfaces.

Application Field

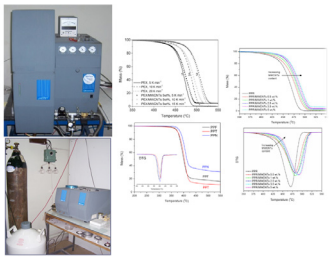
Coatings and thin film technology (anti-corrosion thick coatings) / Thermoelectric Materials (silicides of transition metals such as $CrSi_2$, $MnSi_{1.7}$, Mg_2Si) / Polymer Nanocomposites (thermally conductive polymer nanocomposites, pipes for geothermal applications, thermosetting adhesive from renewable new materials appropriate for particle board-furniture and 3D objects manufacture) / Biomaterials-Bioceramics / Works of Art Preservation / Minerals & Gemstones / aeronautics / precision instruments (isolation of CMM)



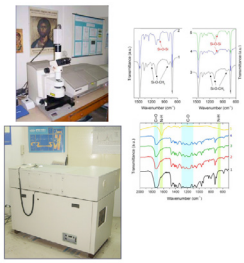
X-ray diffraction (XRD) patterns of the prepared materials are recorded by a water-cooled 2 cycles RigakuUltima diffractometer using CuKa radiation operating at Bragg-Brentano and Grazing Incidence (GIXRD) geometry. For the calculations of the crystallinity percentage, crystalline size and the space between the structural layers of nanocomposites, a deconvolution of the X-ray diffractograms is performed in order to separate the amorphous and the crystalline content.



Surface and depth profiling analysis are performed by X-ray photoelectron spectroscopy (XPS) and Scanning Auger Microscopy and Spectroscopy System (SAM/AES) using KRATOS ANALYTICAL AXIS ULTRA DLD. The elemental composition, the chemical and electronic state of the elements that exist within a material are measured by this sensitive quantitative spectroscopic technique.

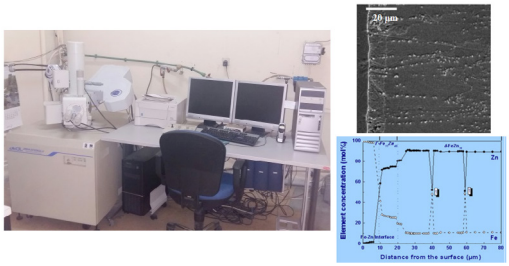


Thermogravimetric and Differential Thermal Analysis (TG-DTA) are conducted by SETARAM model SETSYS 16/18. Materials are extensively studied by TGA in order to identify possible phase transformations by temperature fluctuations and predict the oxidation resistance. Differential Scanning Calorimetry is performed by DSC SETARAM 141 to determine the energy limits of the materials in physico-chemical processes.

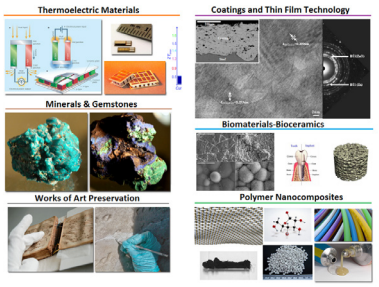


FTIR microscope i-series Perkin-Elmer, connected with spectrometer Spectrum 1000, Perkin-Elmer and FTIR spectrometer IFS 113v Bruker (spectral range from 20.000 to 15cm^{-1} with vacuum operation) are used for the thorough study of the formed bonds.

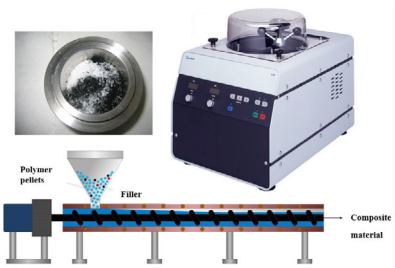
Coatings production using conditions of industrial production line:
•Hot dip galvanizing
•Thermal spraying
•CVD methods
•Electrodeposition
•Cathodic-arc PVD Process



Surface morphology is observed by Scanning Electron Microscopy using JEOL JMS-390LV coupled with Energy dispersive X-ray microanalysis (EDX) for the study of the elemental purity and the stoichiometry.



Field of applications of X-ray, FTIR Spectroscopy and Thermal Analysis Laboratory



Polymers and polymer composites are prepared by melt-mixing in a Haake–Buchler Reomixer (model 600) with roller blades and a mixing head with a volumetric capacity of 69 cm^3. The components are physically premixed before being fed into a RETSCH centrifugal ball mill model S100 for solid-state mixing.

X-RAY, FTIR SPECTROSCOPY AND THERMAL ANALYSIS LABORATORY

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