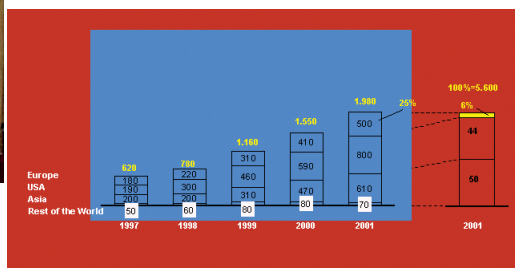
Nanostructured and Multi-Functional Polymer-Based Materials and Nanocomposites (NANOFUN-POLY)

Coordinator: Prof. José M. Kenny, Italian Consortium for Science and Technology of Materials (INSTM)

Prof. José M. Kenny (kenny@unipg.it), coordinator of NANOFUN-POLY presented the Network activities at NANOFORUM Workshop, Sinaia, Romania, October 5, 2003

NANOFUN-POLY joins forces of 25 partners from European countries, and combines knowledge and expertise from chemistry, physics, and engineering, covering experimental and applied aspects of materials science (www.NANOFUN.NET).



Regional Activities in Nanostructure Science

The research areas of excellence of NANOFUN-POLY network are:

Area 1. ***Polymer Chemistry:*** new monomers; new precursors (copolymers, dendrimers, hyperbranched polymers, microgels, nanoclusters); polymerisation routes - chain polymerisation, polycondensation, free radical and radical polymerisation, sol-gel, etc.; and formulation.

Area 2. ***Polymer Processing:*** intelligent and integrated processing; environmentally friendly processing techniques; processing nanocomposites; coatings; patterning of polymer surfaces.

Area 3. ***Nanostructure-Property Relationships:*** new techniques of nanoscale characterization; rheology at different scales; molecular modelling and related simulation techniques.

Area 4. ***Applications:*** mechanical systems; functional coatings; membranes; optical and electrical devices;bioactivity

The specific applications of the POLYMERIC MATERIALS in the MICRO-NANOTECHNOLOGY field are:

- Sensors and biosensors;
- Nanomaterials/nanostructures with various application in medicine and environment;
- Optoelectronics based on polymers and composite materials;
- Field emission devices with carbon nanoparticles embeded in polymeric films
- Microwave devices;
- Photolithographic polymers;
- Polymers with functional properties: conductive, semiconductors dielectrics, optical active, photosensitive, photocromics, senzitive, magnetics, field emission, biodegradable, biocompatible, hidrophylic, organometalics, etc.;
- Polymeric films as support for nanoparticles;
- Protective polymers.

The Romanian consortium participation in NANOFUN-POLY network

is realized by a Romanian Consortium for Nanostructured Polymers - RCNP.

The two partners from the Romanian Consortium for Nanostructured Polymers are:

- NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN MICRO-TECHNOLOGIES IMT-BUCHAREST General Manager: Prof. Dan Dascalu (dascalu@imt.ro), Project coordinator: Dr. Irina Kleps (irinak@imt.ro);
- NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT FOR ISOTOPIC AND MOLECULAR TECHNOLOGIES (Group of the Conductive polymers), Cluj-Napoca; General Manager: Dr. Mircea Bogdan; Project coordinator: Dr. Rodica Turcu (turcu@s3.itim-cj.ro).

The research activities of the RNCP cover the entire area of research of NANOFUN-POLY network, as follows:

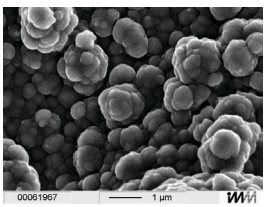
- Polymer chemistry and nanostructure-properties correlation: Conducting polymers like polypyrrole (PPY) and nanostructured composites based on PPY (I N C D - T I M - C l u j -Napoca);
- Polymer processing and applications (IMT-Bucharest)

Areas of excellence:

- **INCD-TIM:** (1) Polymer Chemistry and (3) Nanostructure - Properties Relationships with topics: New precursors (copolymers, dendrimers hyperbranched polymers, microgels and nanoclusters); Formulations using hybrid structures (organic-inorganic, nanocomposites, nanotubes containing systems); Synthesis of polymers with special optical, electrical, magnetic and responsive properties; Electroactive systems: generation and transport of charge in nanostructured systems with conductive, semiconductive and photoconductive polymers, electroactive membranes and polymer batteries, phase separated blends with conducting components, photovoltaic devices.
- **IMT-Bucharest:** (2) Polymer processing:Polymer microstructuring for microsystem applications; Sub-micronic photolithography; (4) Applications: Polymers for biomedical applications; biocompatible/ permeable / resorbable polymers (Possible applications:Tissue engineering and drug delivery systems); Investigation of the porous silicon /polymer composite materials for microsystem applications; CNT-polymeric composites; emitter inks based on conducting or semi-conducting particles dispersed in a polymeric binder (Possible applications: Vacuum microelectronic devices); Transparent conductive polymers (Possible applications: Electroluminescent devices); Nanoelectrode arrays on polymeric films as templates.

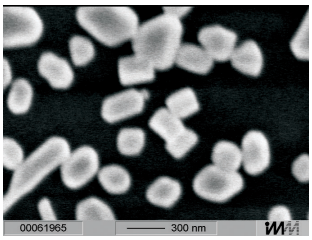
Methods available: FTIR, UV-Vis, EPR, X-ray diffraction, EXAFS, SEM -EDX, conductivity, AAS, AFM, XRD, microsystems design and technological processes (electrochemical methods, photolithographic processes, vacuum evaporation deposition, high temperature processes, plasma etching, LPCVD).

IMT-Bucharest competence: micro and nanostructures - design, technology and applications

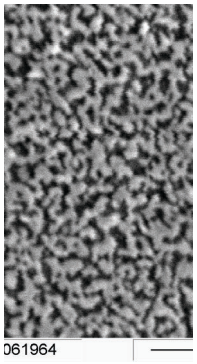


Polypyrol electrochemical deposited on PS

CVD-DLC on PS



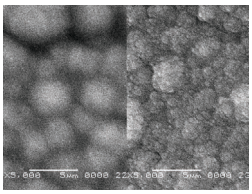
Gold deposited on PS



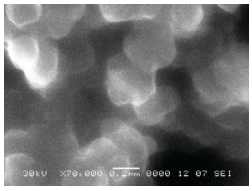
In deposited PS

INCD-TIM - Cluj-Napoca competence:

- **Conducting polymers: polypyrrole (PPY);**
- **Composite materials obtained by combining conducting PPY with inorganic or organic nonconducting components like: SiO_2, Fe_2O_3, zeolite, polystyrensulfonate, polyvinylalcohol, polyvinylchloride**

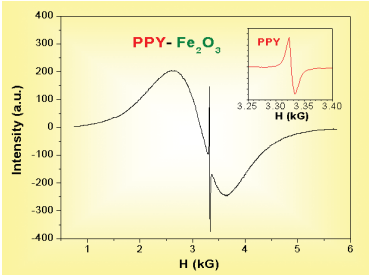


SEM image of electrochemically prepared PPY doped with different ions



SEM image of PPY-SiO_2 nanocomposite

SEM image of PPY nanotube prepared by chemical oxidative polymerization.



ESR spectrum of PPY-Fe_2O_3 nanocomposite.