# Institutul de Chimie Macromoleculară "Petru Poni" al Academiei Romane

## Cercetare fundamentală de excelenţă şi orientări aplicative


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**e-mail: pponi@icmpp.ro, http://www.icmpp.ro**



*Simpozionul "De la excelenţă la competitivitate: tehnologiile generice esenţiale"*
**15 mai 2014 , Aula Academiei Române**

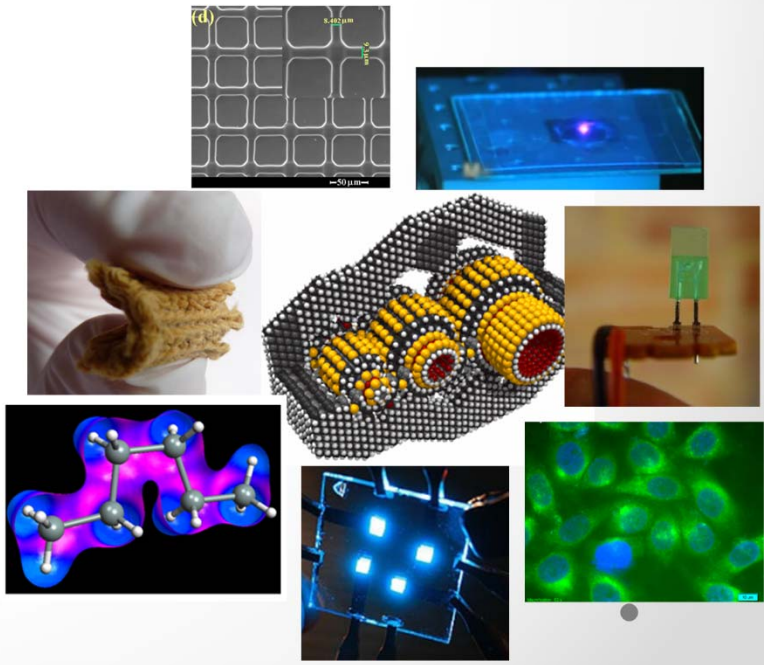
| Misiune | Indicatori de performanţă |
|---|---|
| • **Cercetare fundamentală în ştiinţa polimerilor** | *Rezultate obţinute în cercetare în 2013*<br>✓ *lucrari publicate in reviste ISI din strainatate/reviste ISI din Romania: 257/55*<br>✓ *capitole carti aparute in strainatate: 16*<br>✓ *capitole carti aparute in alte edituri decat editura AR: 27*<br>✓ *carti publicate in strainatate/in Romania: 1/4*<br>✓ *Brevete in Romania: 5*<br>✓ *citari ale lucrarilor publicate anterior, in anul 2013: > 2490* |
| • **Cercetare aplicativă, transfer tehnologic, microproducţie** | ✓ *tehnologii industriale pentru: siliconi (uleiuri, elastomeri, răşini, adezivi, lubrifianţi), adezivi, poliuretani (piele sintetică, adezivi, unsori de blocare), schimbători de ioni* |
| • **Educaţie prin cercetare** | ✓ *specializare prin intermediul programelor doctorale şi/sau postdoctorale a tinerilor cercetatori*<br>✓ *peste 90 de teze de doctorat elaborate în institut în perioada 2003 – 2013* |
| • **Servicii** | ✓ *consultanţă în sinteza şi caracterizarea polimerilor şi materialelor polimere*<br>✓ *activitate de transfer de cunoştinţe*<br>✓ *certificare de materiale polimere* |

## Direcții de cercetare

- *Chimie supramoleculară, fizico-chimia suprafețelor*
- *Materiale polimere din resurse regenerabile. Protecţia mediului. Conservarea energiei*
- *Materiale polimere proiectate pentru bioaplicaţii*
- *Polimeri pentru aplicaţii de înaltă performanţă. Materiale nanodimensionate/ nanostructurate*

## Tehnologii generice esențiale

- *Nanotehnologii*
- *Materiale avansate*
- *Fotonică*
- *Micro/nanoelectronică*



Dr. Maria BRUMA
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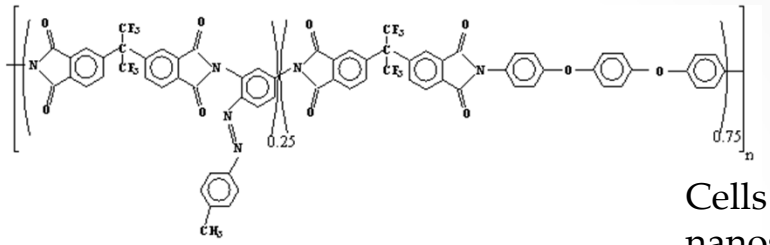
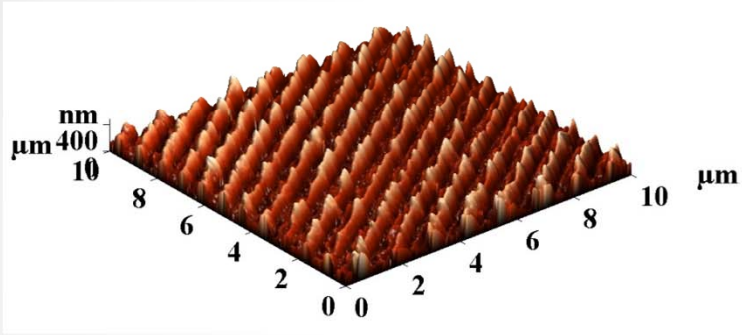
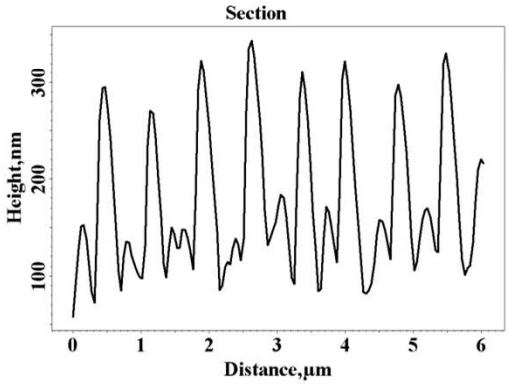
# Nanotehnologii

## *Nanostructured azo-polymeric films as support for cell cultures acting as 3D extracellular matrix*

Surface relief gratings as a result of *trans-cis* isomersation of the azo-benzene groups linked to a polyimide



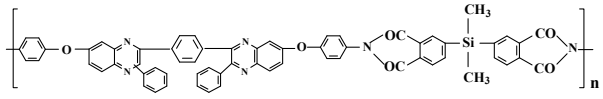


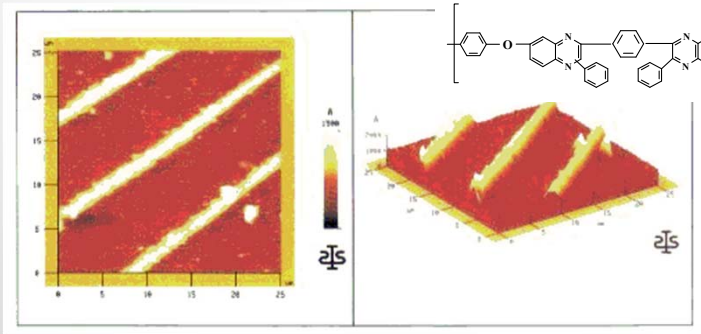



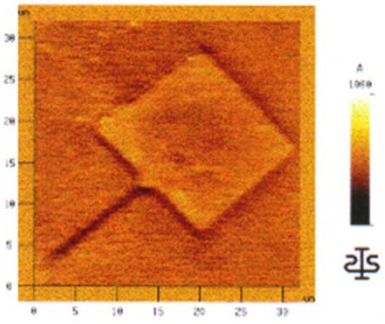

Cells culture on the nanostructured film

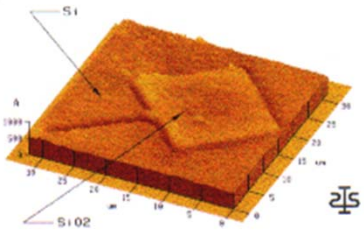
*Mater. Chem. Phys., in press*

## *High quality very thin films for electron-beam lithography*









*In "Functional organic nanostructures and thin organic films", eds.: J. Reiche, B. Schulz, S. Schrader, B. Stiller (2004)*

Dr. Maria Cazacu
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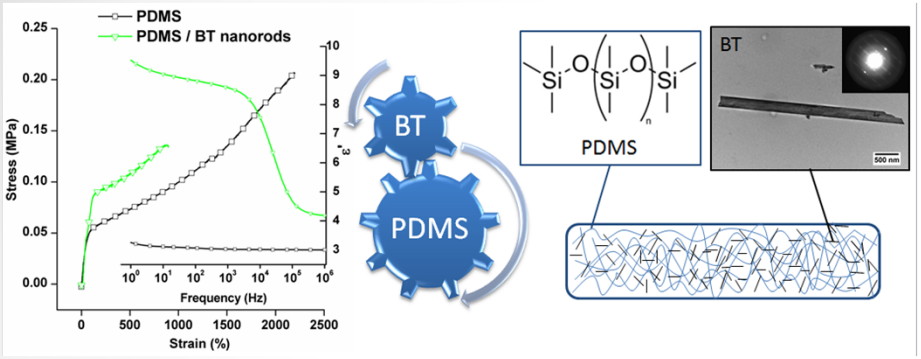
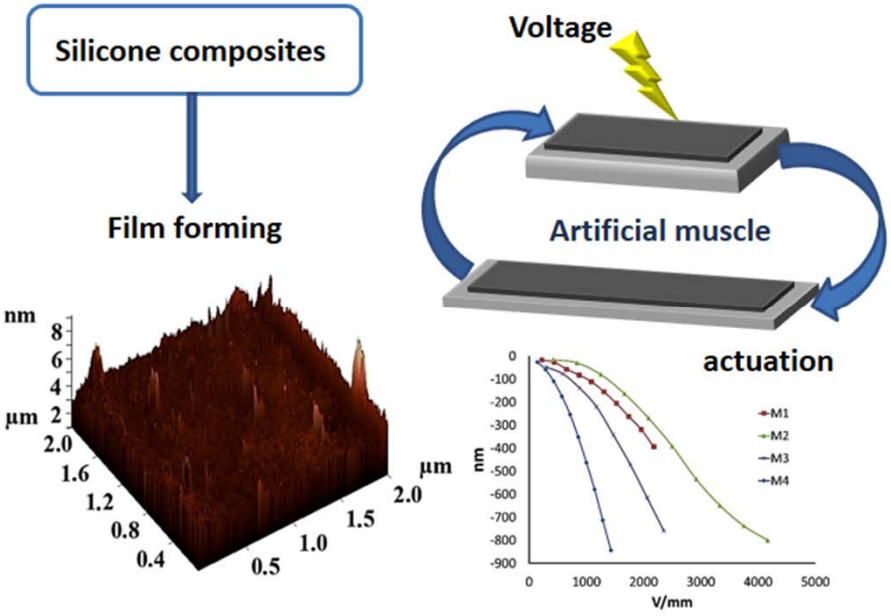
# Nanotehnologii

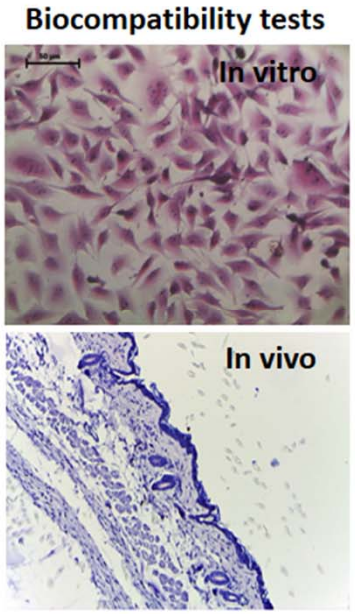
## *Energy harvesting using polymers / Artificial muscles*




PolyWEC
polymeric wave energy converter

Scuola Superiore Sant'Anna
selmar
THE UNIVERSITY of EDINBURGH
WavEC




*Materi. Sci. Eng. C – Mater. Biol. Appl., accepted paper*

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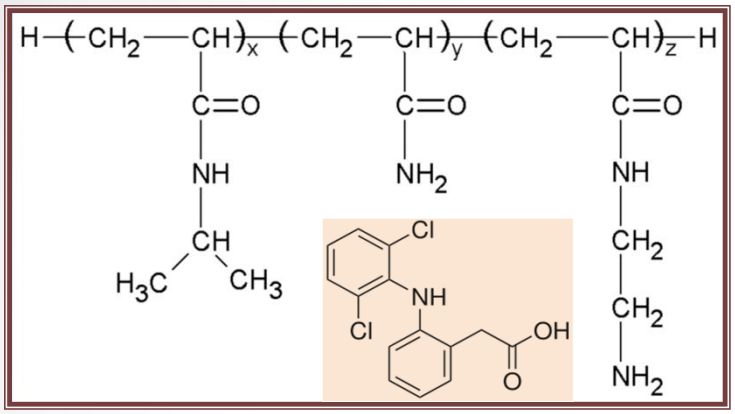
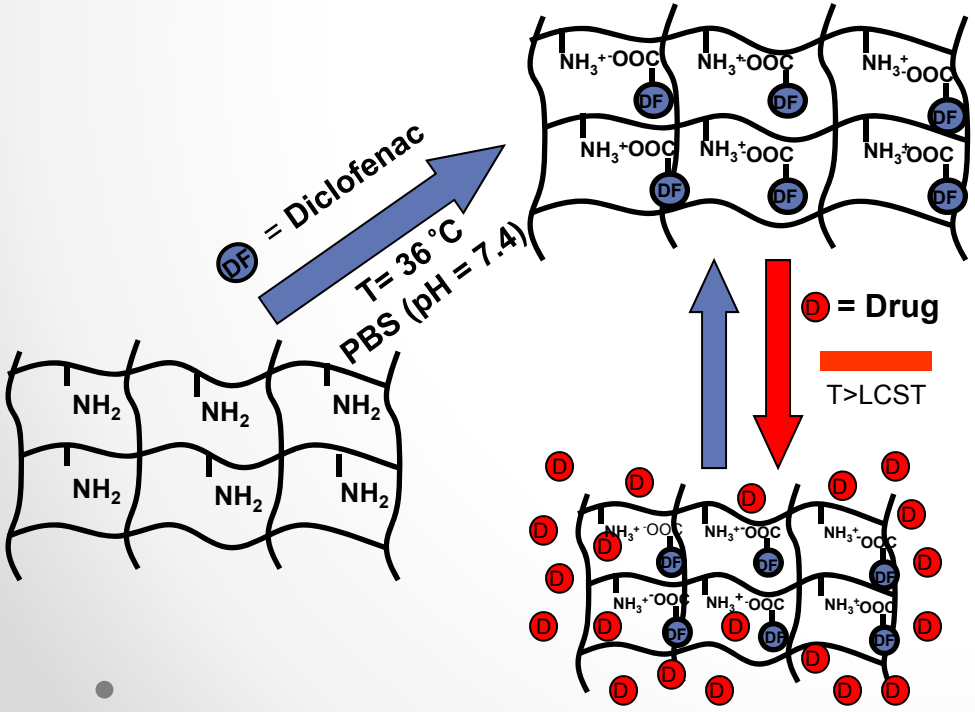
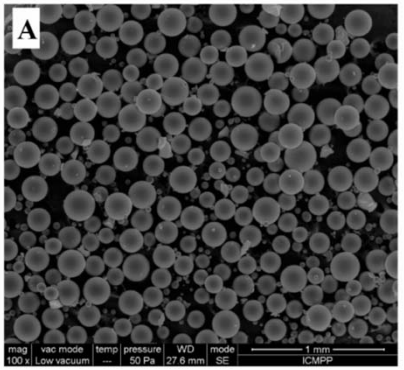
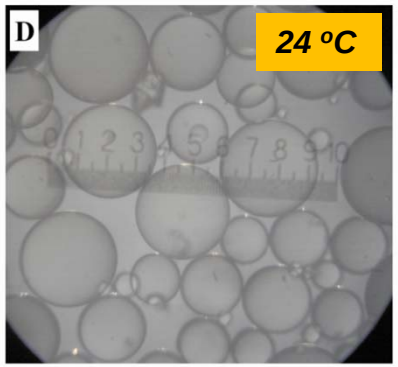
# (Bio)Nanotehnologii

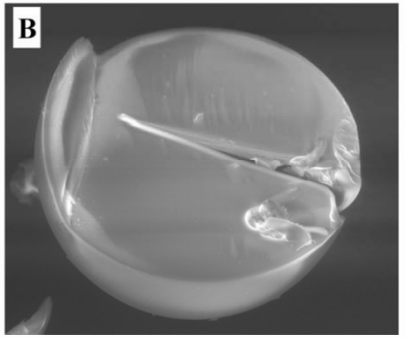
*Advanced self-regulated drug delivery systems based on a sensor (pH-sensitive units) and a delivery component (thermosensitive units)*

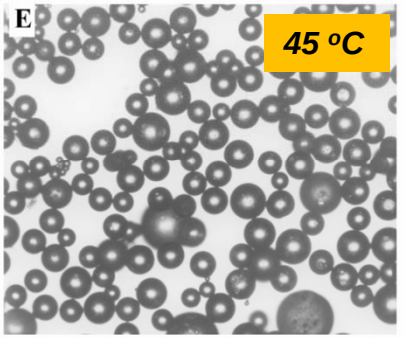


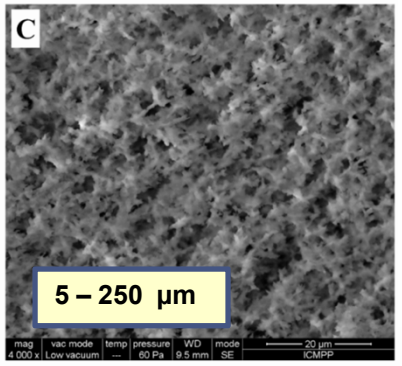



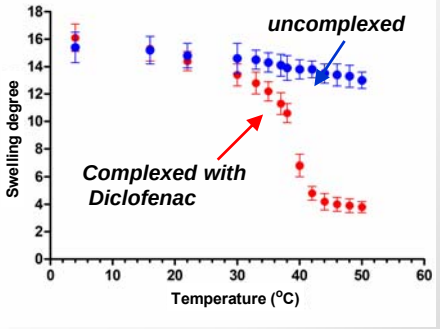




*J. Biomed. Mater. Res.* 101 A (6), 1661-1669 (2013)

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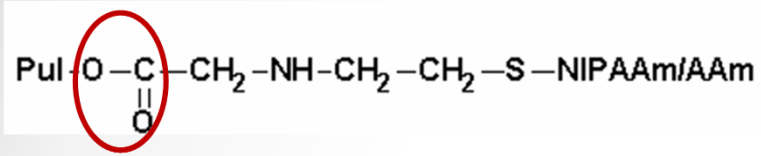
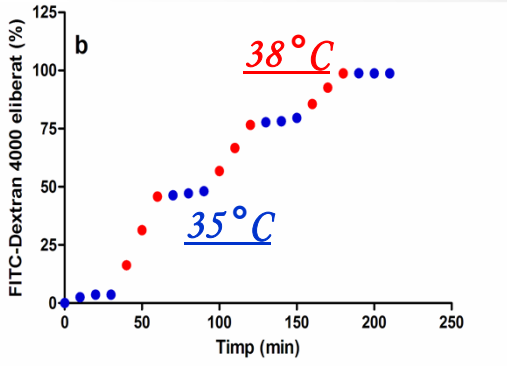
# (Bio)Nanotechnologies

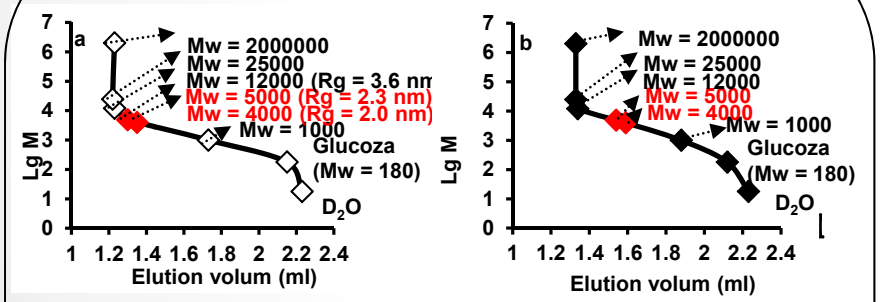
## *Intelligent devices for entrapment and release of drugs by a strict "on-off" mechanism*

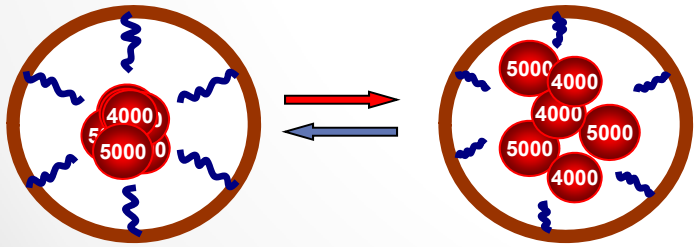



**NIPAAm/AAm (mol %)** → 10/1.5 (pH = 7.4) → LCST (°C) = 37.4 °C (1500 g/mol)
37.8 °C (3300 g/mol)




### Mn = 1500 g/mol

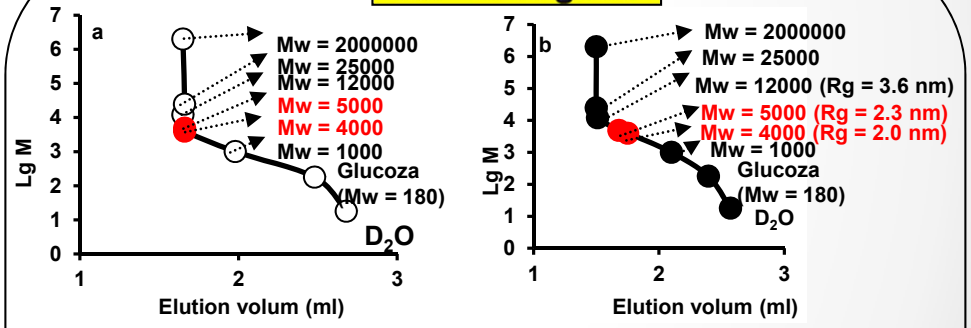


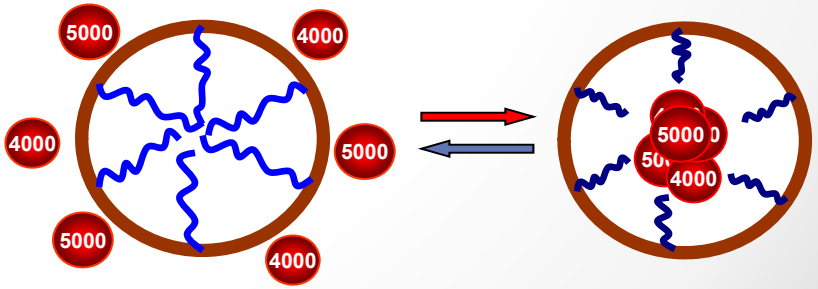




Vp → 4,44 ± 0,18 ml/g — T<LCST

Vp → 4,0 ± 0,12 ml/g — T>LCST

### Mn = 3300 g/mol




Vp → 4,56 ± 0,15 ml/g — T<LCST

Vp → 4,18 ± 0,10 ml/g — T>LCST

*Biomaterials 31 (36), 9544-9553 (2010)*

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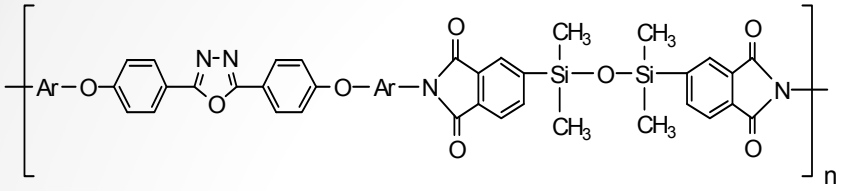
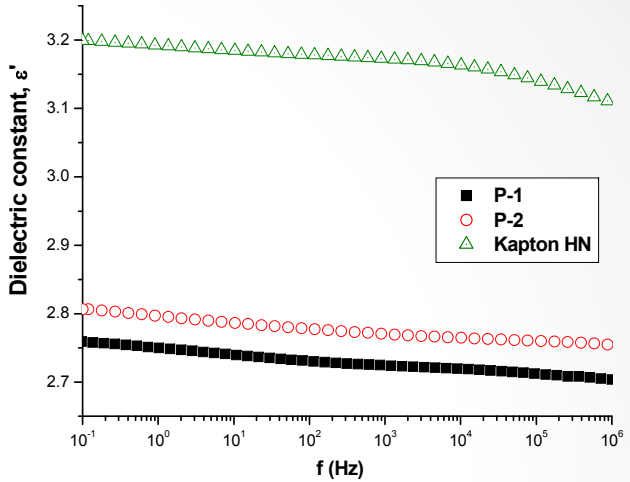
## Nano-electronica

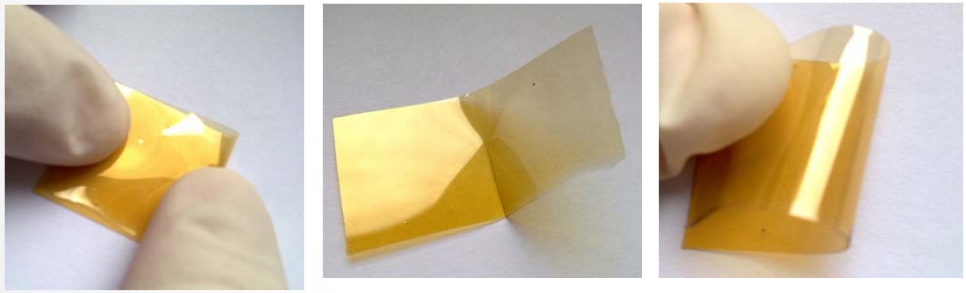
### *Low-K polyimide films for dielectric interlayers*

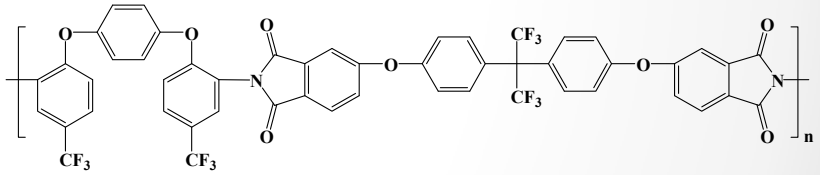



*Eur. Polym. J., 46, 1049–1062 (2010)*




### *Fluorinated polymers for flexible and transparent substrates in plastic electronics*

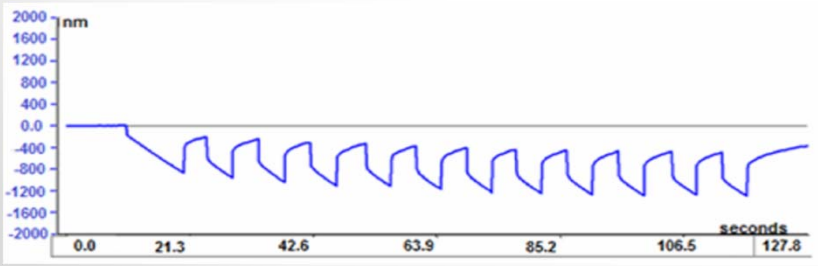


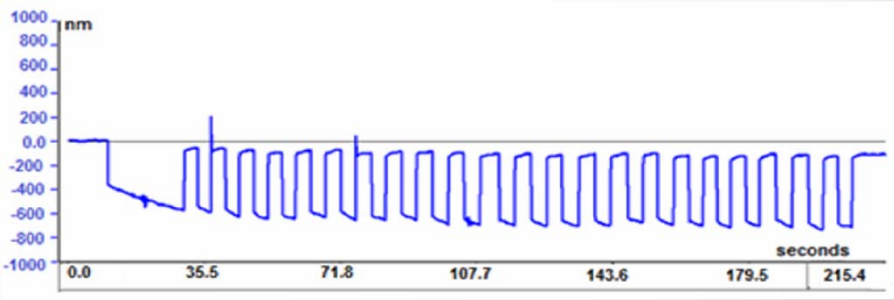



*Eur. Polym. J., 50 200–213 (2014)*

### *Polymer-based microactuators*

**Cerere brevet de inventie RO127096-A2/ 28 Feb 2012**



Dr. Liviu Sacarescu
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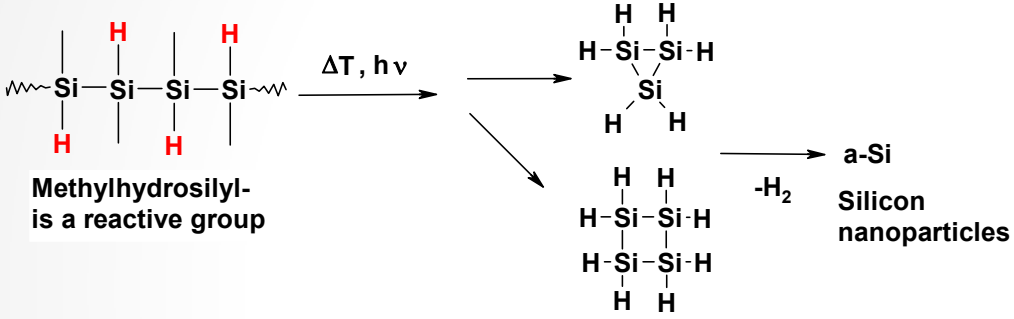
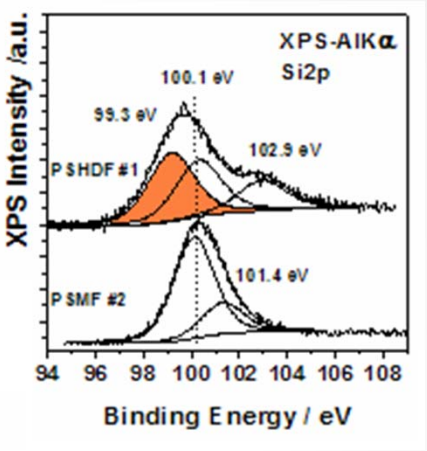
## Nano-electronica

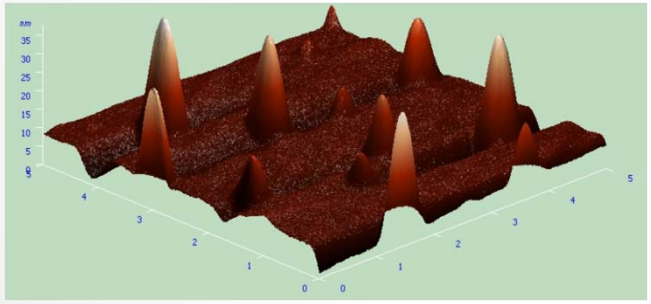
# Polyhydrosilanes: PPIMC Route to Optoelectronics

*In situ* Si nanoparticles by chemo-restructuration

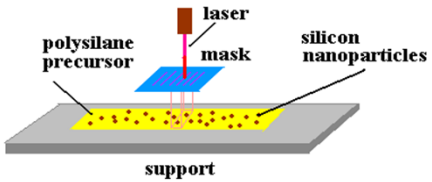


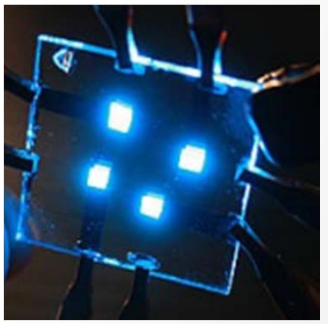

XPS Investigations of polyhydrosilane films showed elemental Si



AFM image of Si nanoparticles embedded within semiconductive polyhydrosilane matrix




OLEDs by microlitography

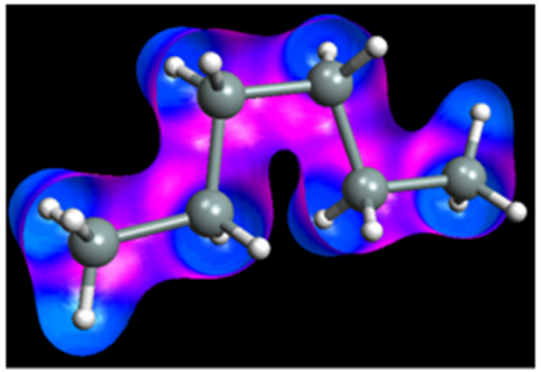


Tests in Waker Co. Laboratories

*Macromol. Chem. Phys.*, 210, 2015-2021 (2010); *Design monomers and polymers*, 15(2), 127-136 (2012)

Dr. Liviu Sacarescu
(livius@icmpp.ro)

# Nanosenzori

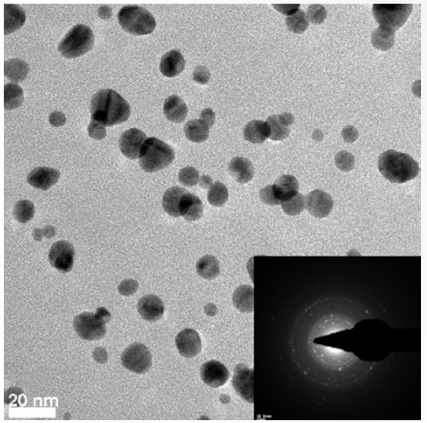


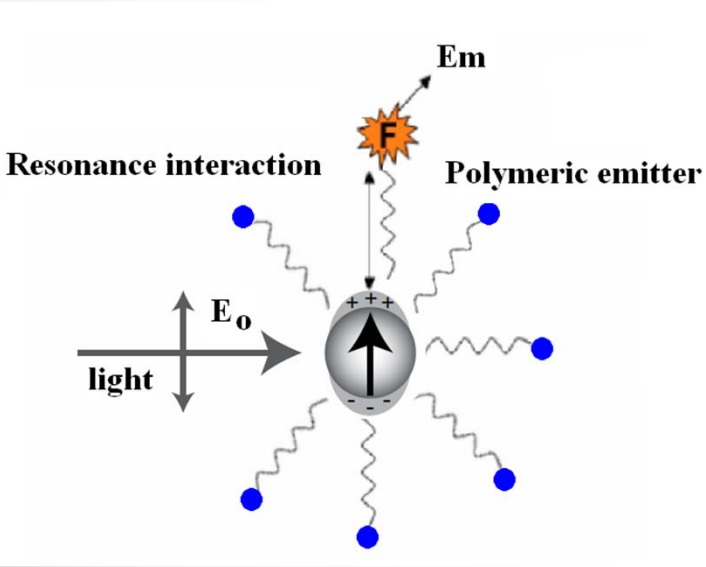
Highly reactive polysilane

In situ

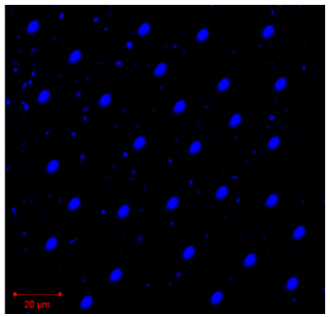
Photocatalytic process

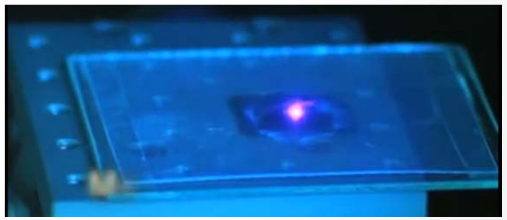
AgNP polymer matrix




Surface Enhanced Fluorescence





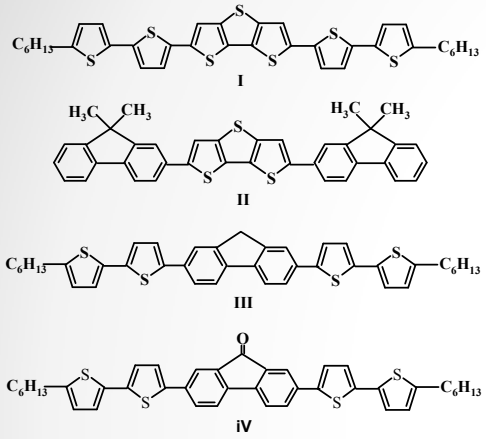
*Tests ongoing in Australian Institute for Bioengineering and Nanotechnology/Australian National Fabrication Facility -QLD Node, The University of Queensland*

*Polym. International*, 61(12), 1726-1732 (2012); *J. Nanopart. Res.*, 13, 997-1005 (2011)

Dr. Luminita MARIN
(lmarin@icmpp.ro)

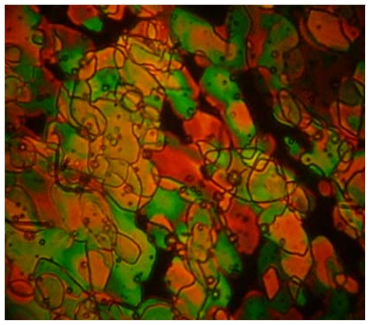
# Micro- si nano-electronica

*Liquid crystals for field effect transistors (FET) and light emitting diodes (LED)*

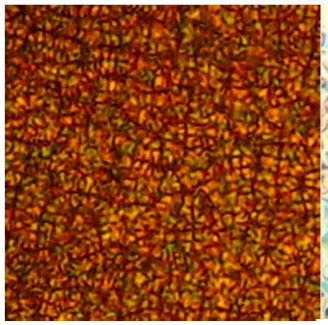



**Optical microscopy micrography of the FET**

**I**, 1C, 290 °C, 200x, 90 °C/min, phase transition nematic/smectic

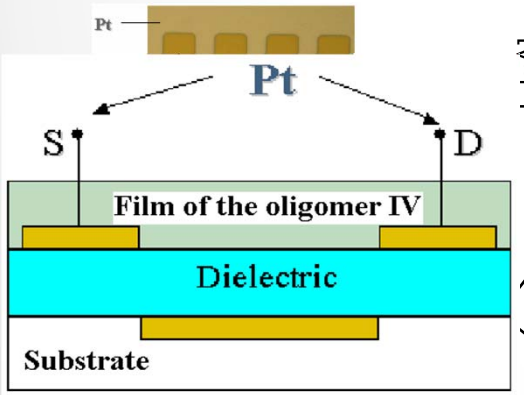


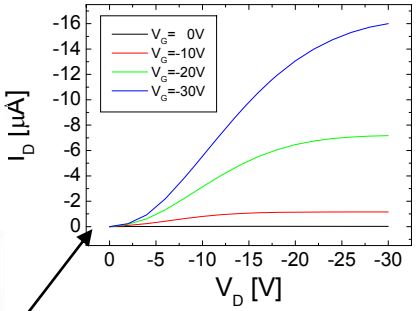
**II**, 2H, 254 °C,400x, mosaic texture



**III,** 1H, 355 °C, 400x, fine texture

**IV**, 1C, 300 °C, 200x, Schlieren and focal conic texture

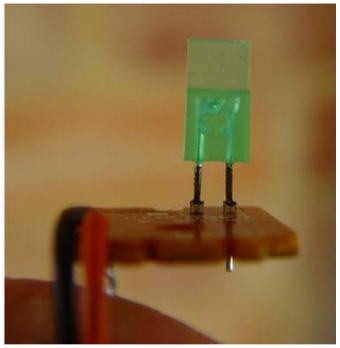


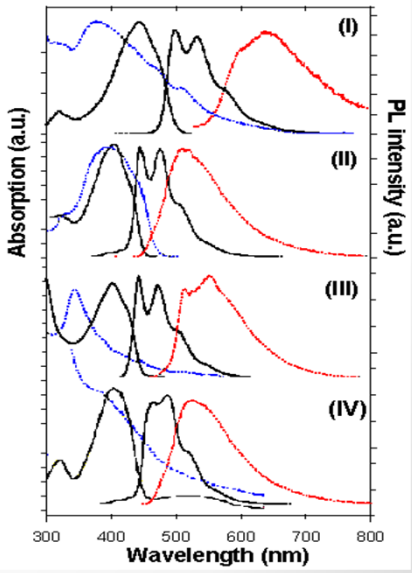

**μ : $10^{-4}$ - $10^{-3}$ $cm^2/Vs$**

**μ : 5× $10^{-2}$ $cm^2/Vs$, $T_{sub}$ = 130° C**

## LED imaging of II



high solid-state quantum yield (0.30 *vs* 0.63 in THF solution)



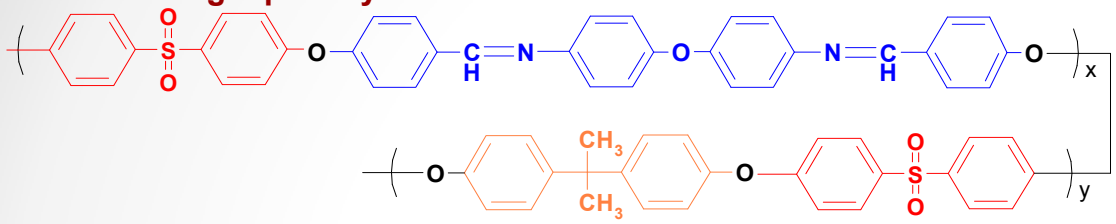

*Thin Solid Films, 515, 7318 – 7323 (2007), J. Optoelectr. Adv. Mater., 9 (5), 333 – 341 (2007), Liquid Crystals, 36, 21 – 32 (2009)*

Dr. Luminita MARIN
(lmarin@icmpp.ro)

# Micro- si nano-electronica

## Thermotropic liquid crystals for optoelectronic applications

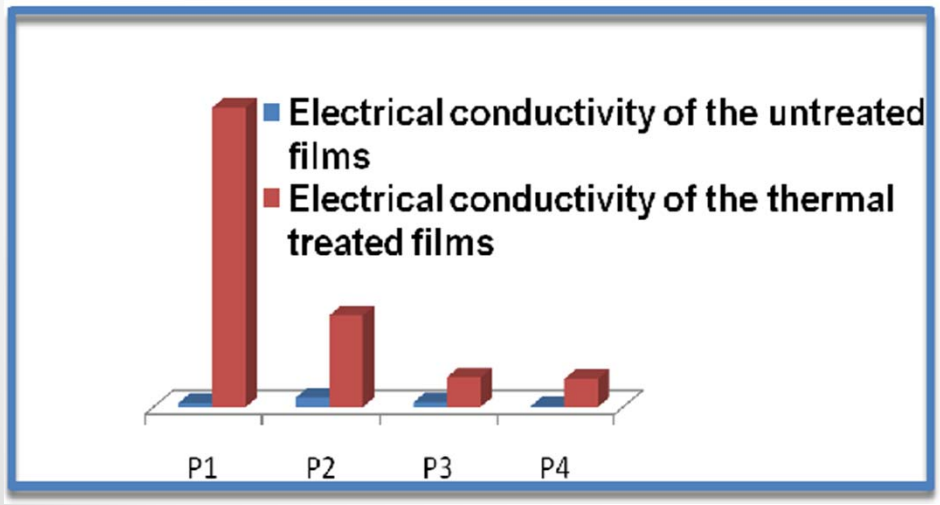
**Semiconducting liquid crystals**

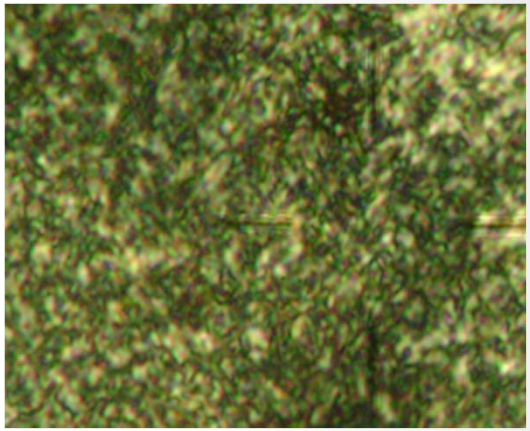


y=1-x

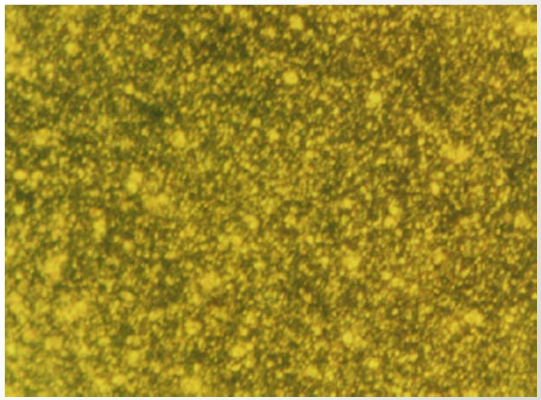
**Good solubility in dipolar solvents**
**High thermal stability**
**Thermotropic liquid crystalline behavior**
**Semiconducting properties**

→ **Continuous ordered films**



**P3:** 1H, 225 °C, fine grainy texture



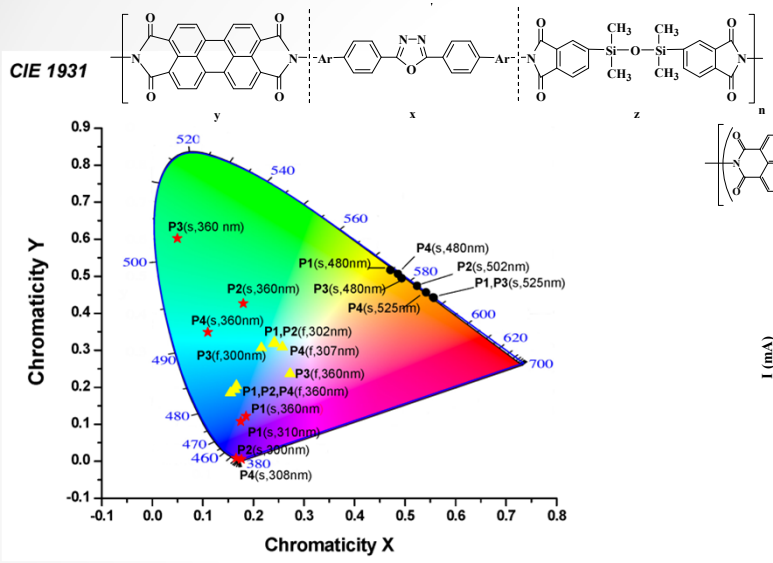
**P4:** 1H, 210 °C, fine texture

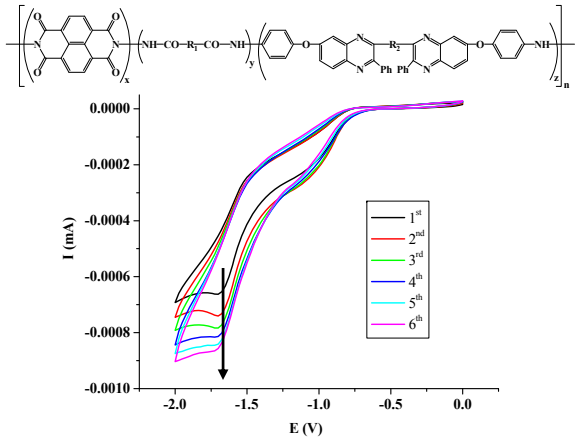
*Polym. Adv. Technol., 17 (9-10), 664 – 672 (2006)*
*Acta Materialia, 55 (2), 433 – 442 (2007)*
*Thermotropic Liquid Crystalline Poly(azomethine-ether-sulfone)s. Synthesis and properties, Kerala, India (2010)*

Dr. Maria BRUMA
(mbruma@icmpp.ro)

**Fotonica**

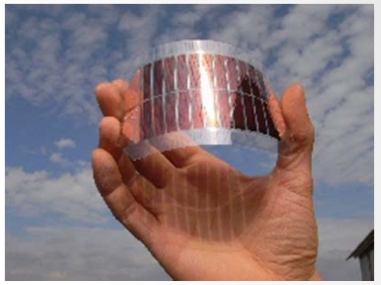
## *Luminescent and electron-transporting materials for opto-electronic devices*




*Dyes Pigments, 99 , 228-239 (2013)*

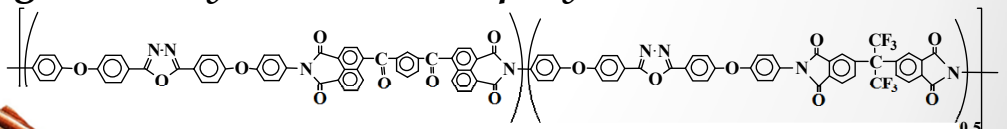
## *Dyes and polymers for phtovoltaic cells*

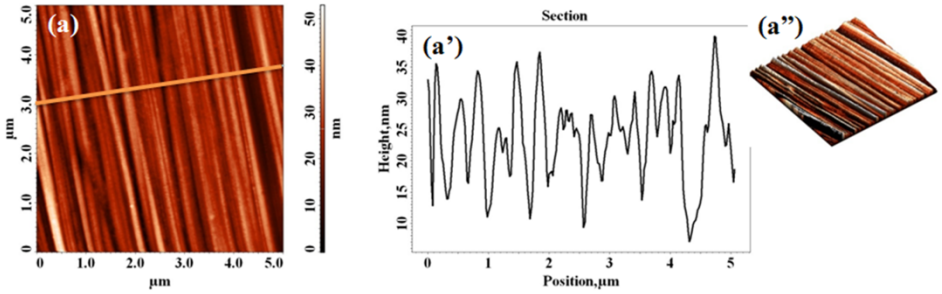


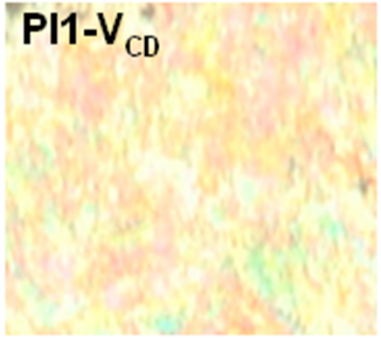
-Peryleneimide based materials
-Naphthylimide based materials
-Thiophene-based materials

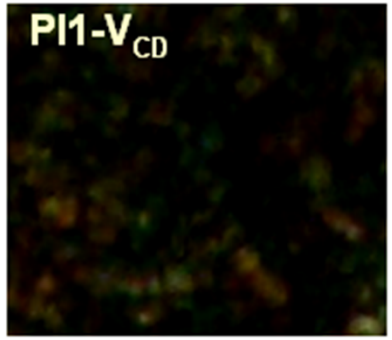
***J. Polym. Res., in press***

## *Polyimide films for liquid crystals (LC) alignment layers in LCD displays*






*J. Mater .Sci ., 49,3080–3098 (2014)*

Dr. Ioan CIANGA
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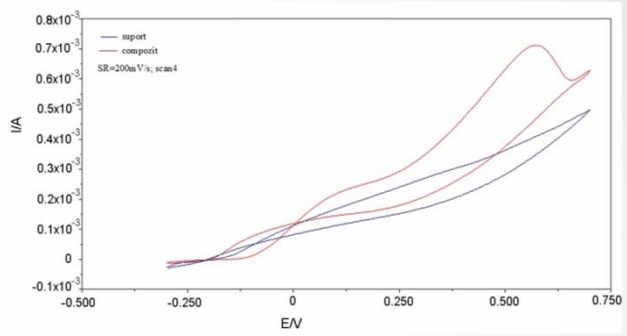
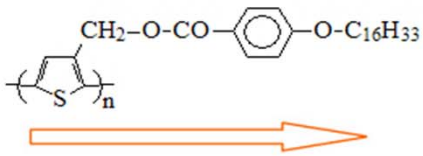
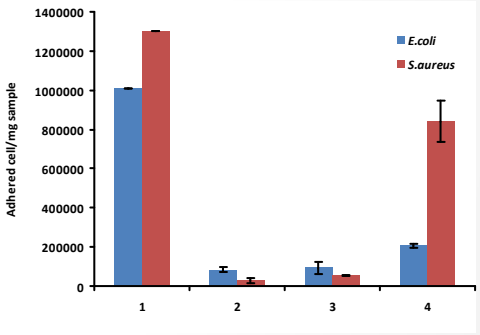
## Materiale avansate

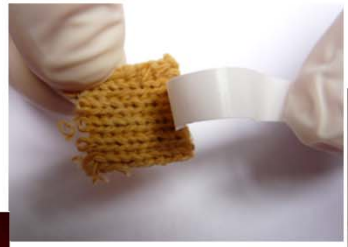
# *An Alternative to Sustainable and Biodegradable Organic Electronics - Cotton Fabric - Conjugated Polymers Composite*

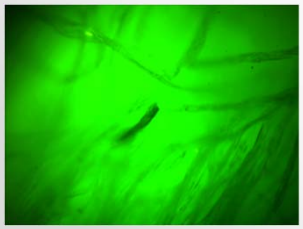
Cotton is the fabric of your lights, of your keyboard, or of your cell-phone

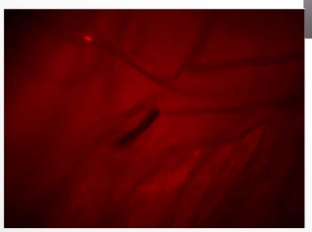



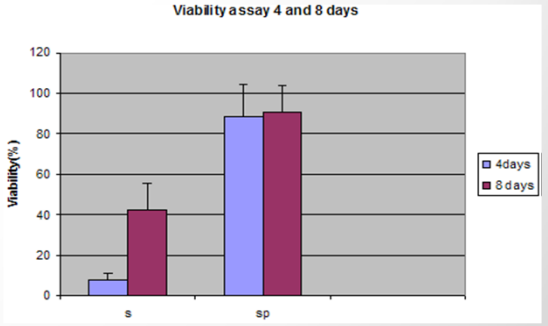










*Bull. Inst. Pol. Iasi, Tomul LVI (LX), Fasc. 3, Sectia Textile-Pielarie, pp. 58-66/ 2010*
*Proceedings of International Symposium in Knitting and Apparel, Iasi, Romania 2010, pp1-11*

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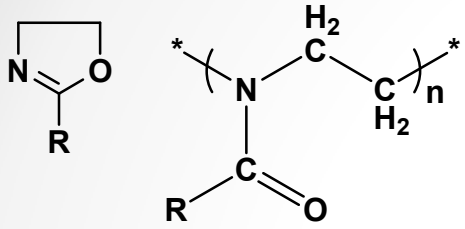
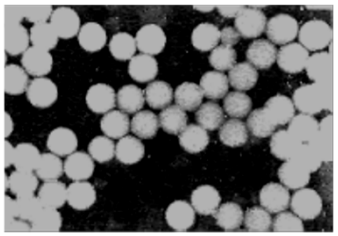
(bcsimion@icmpp.ro)

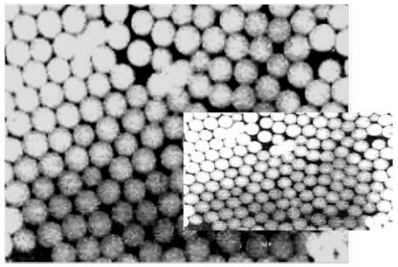
## Materiale avansate

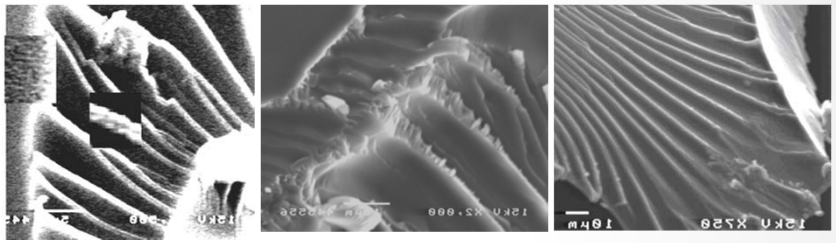
# *Functional micro- and nanoparticles based on PNAI building blocks / PNAI-based gels*



drug release systems
uniform thin polymer films (electrode coating, biosensors)
high selectivity membranes

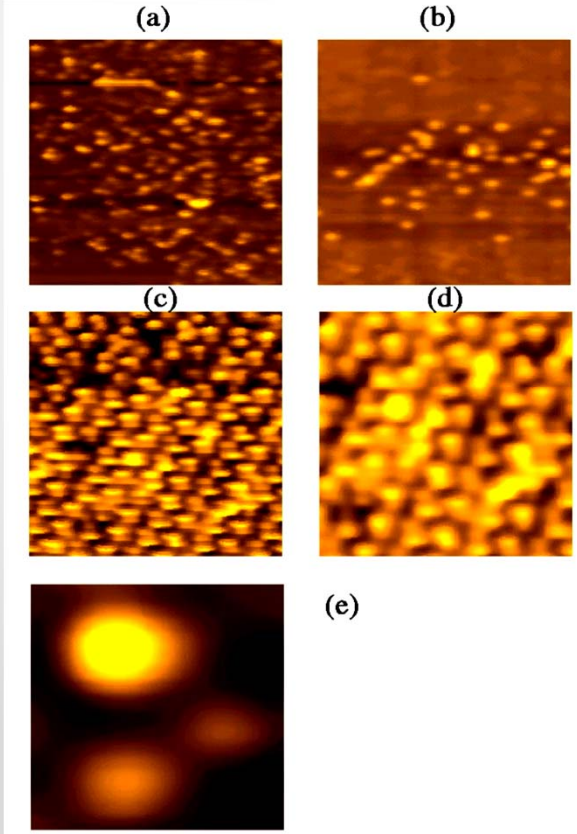




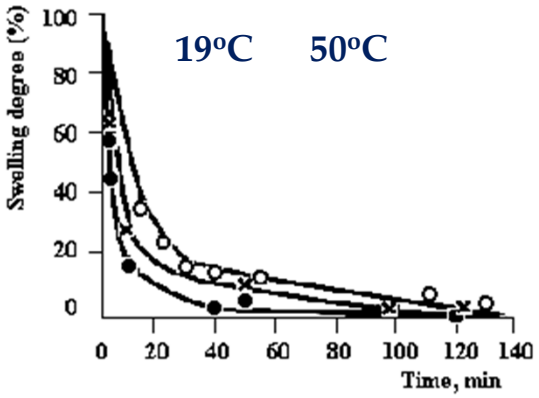
self assembled core-shell microparticles
interconnected pore structure

large channels
open macropores

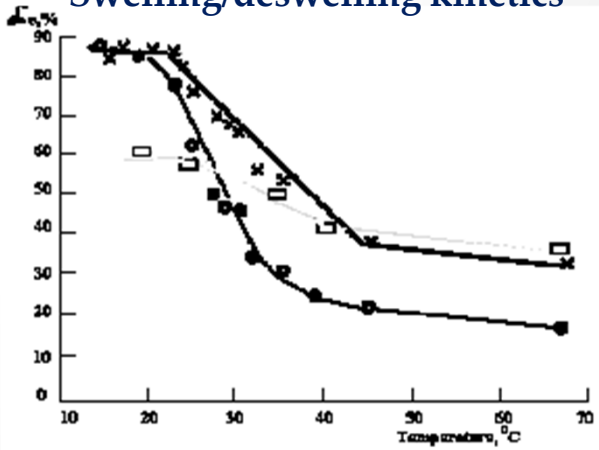
**HEMA/NIPAAm/PROZO w/w/w - 1:1:1**




*Biomacromolecules, 9, 1678 – 1683 (2008)*




Swelling/deswelling kinetics

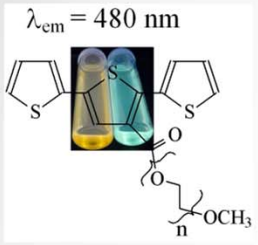


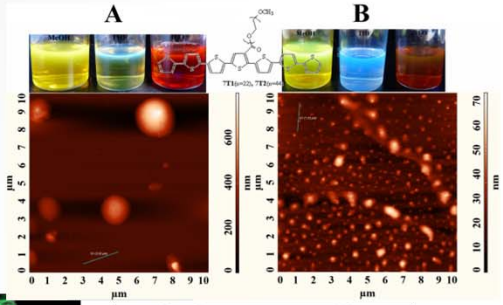
*Institutul de Chimie Macromoleculară "Petru Poni" Iaşi*

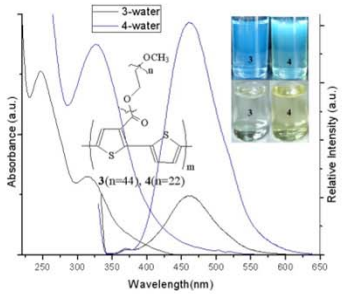
**Dr. IOAN CIANGA**
**(ioanc@icmpp.ro)**

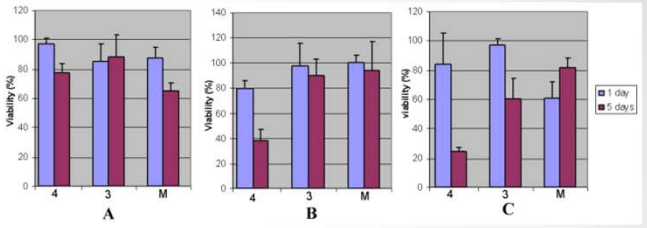
## Materiale avansate

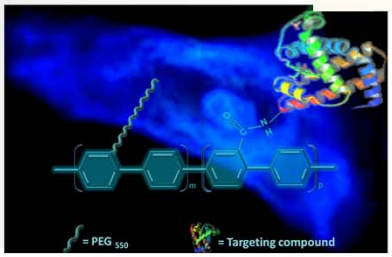
# *Multifunctional Nanostructured Materials Based on Conjugated Polymers for Bioapplications*



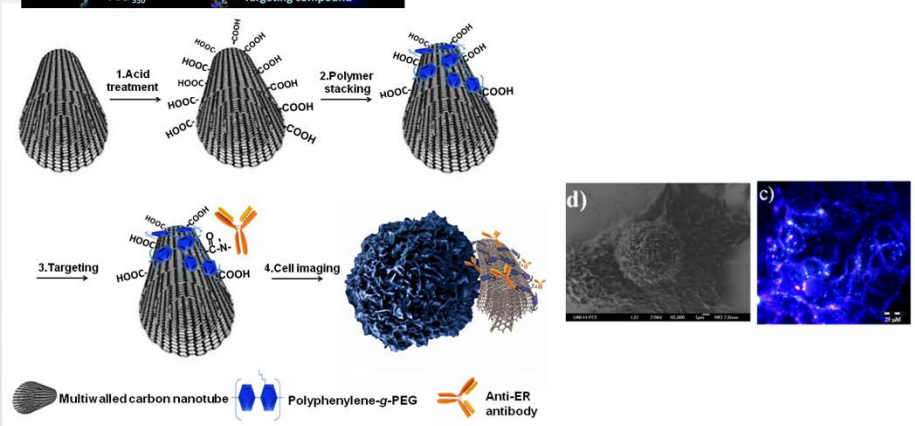



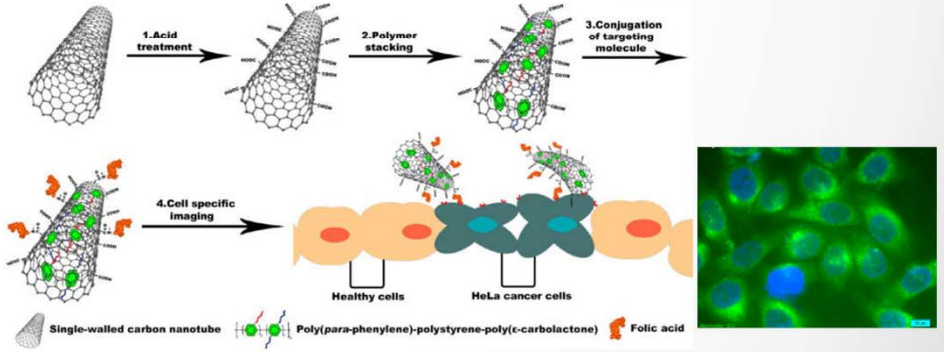



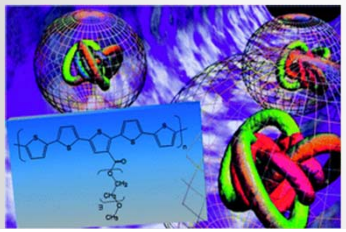



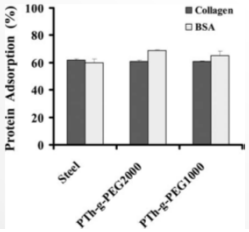



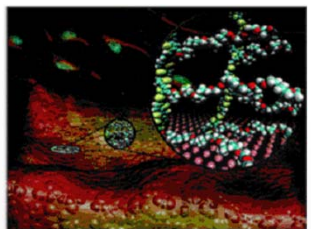

*Rev. Roum. Chim., 58 (2-3), 153-160 (2013); Int. J. Polym. Anal. Charact., 18: 189–198, (2013); Mater. Plast. 50 (2),71-78, (2013); J. Mater. Chem., 22, 9293-9300, (2012); Biomacromolecules, 13, 2680-2691, (2012); Biomacromolecules, 14, 3532-3541 (2013); Polym. Chem., 4, 2709-2723, (2013); J. Mater. Chem. B, 1, 4135-4145, (2013); Polymer (submitted).*

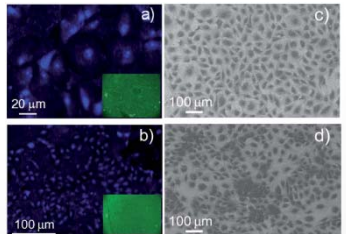


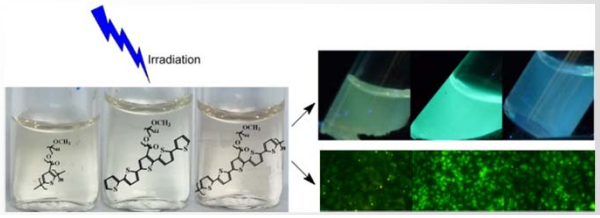







Dr. Ecaterina Stela DRAGAN
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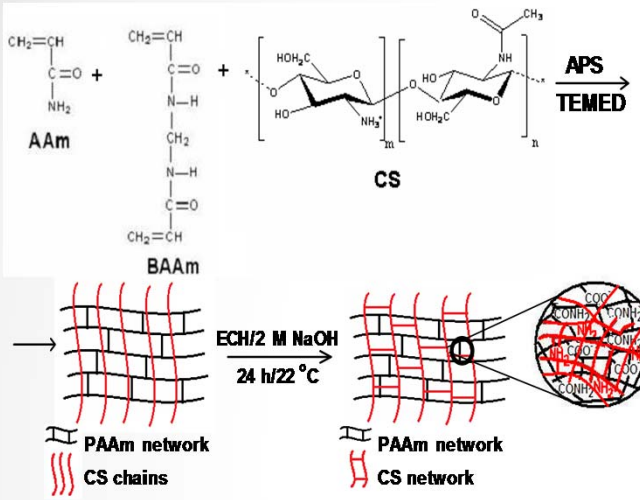
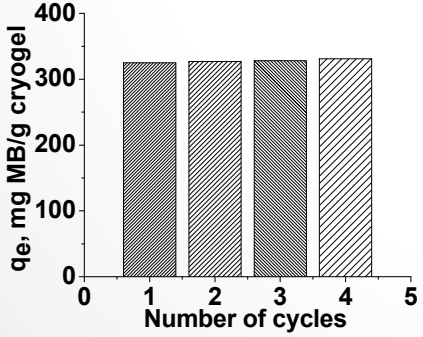
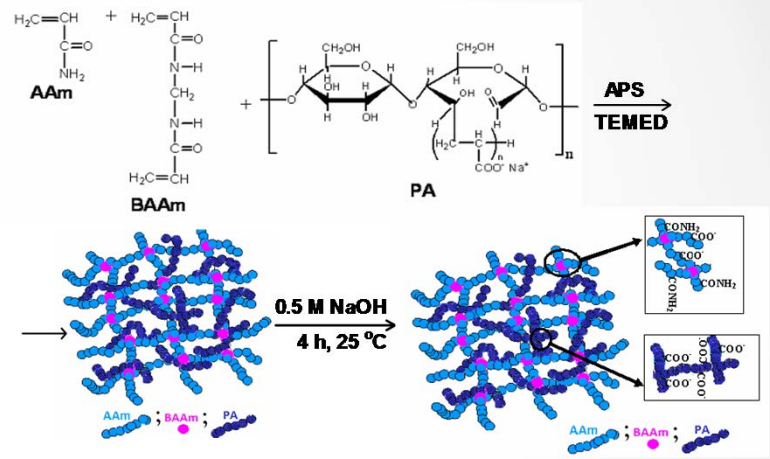
**Materiale avansate**

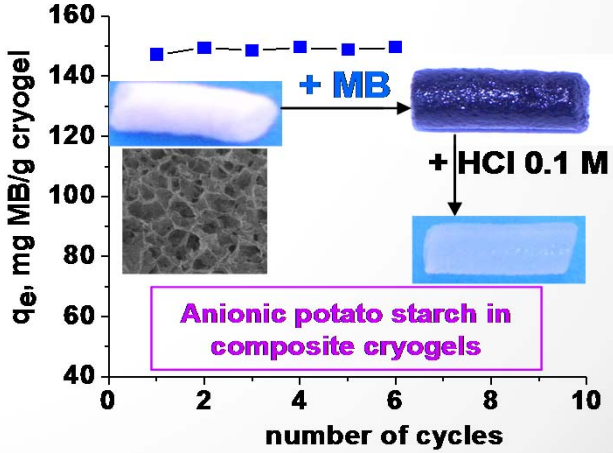
# *IPN cryogels based on polysaccharides and polyacrylamide used in separation processes of ionic species*








- *Chem. Eng. J. 204-206, 198-209 (2012)*
  *Chem. Eng. J. 243, 572-590 (2014)*

*Chem. Eng. J. 234, 211-222 (2013)*

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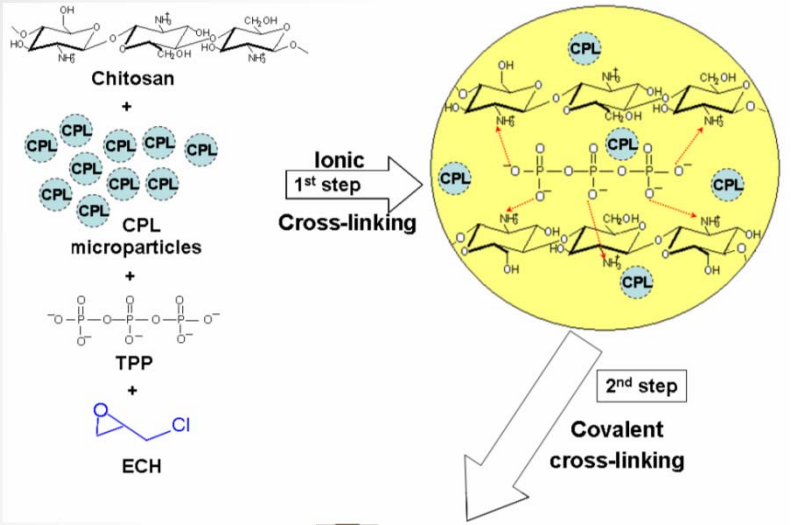
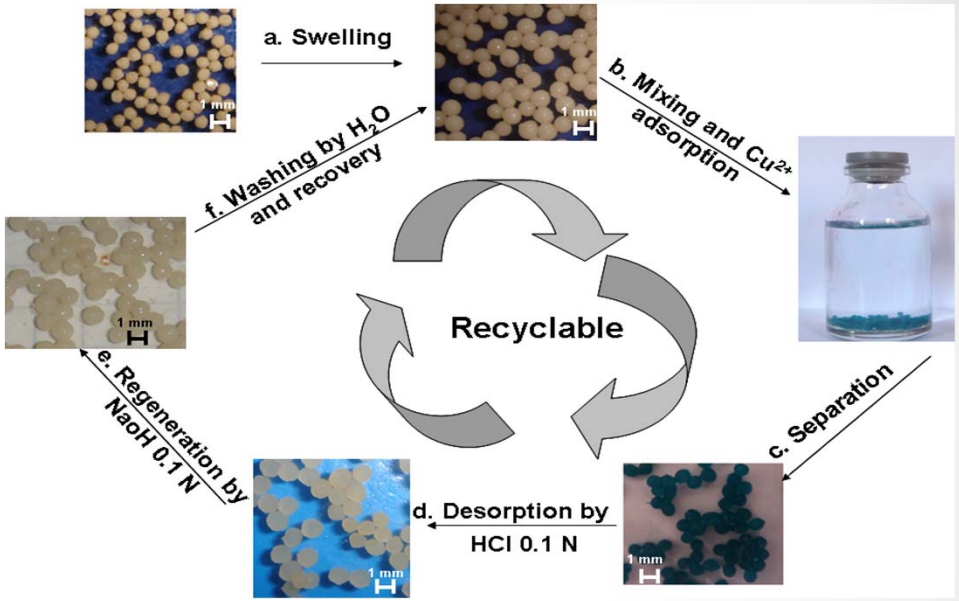
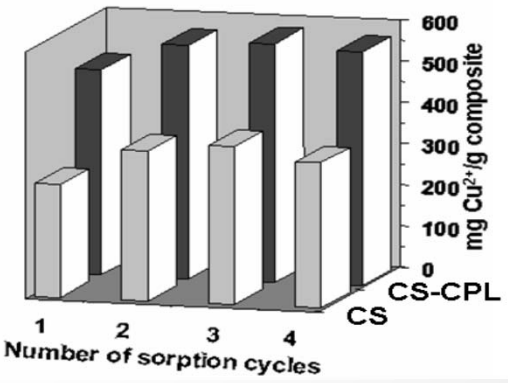
## Materiale avansate

# *Enhanced sorption of heavy metal ions onto composite sorbents based on chitosan and zeolites (clinoptilolite)*



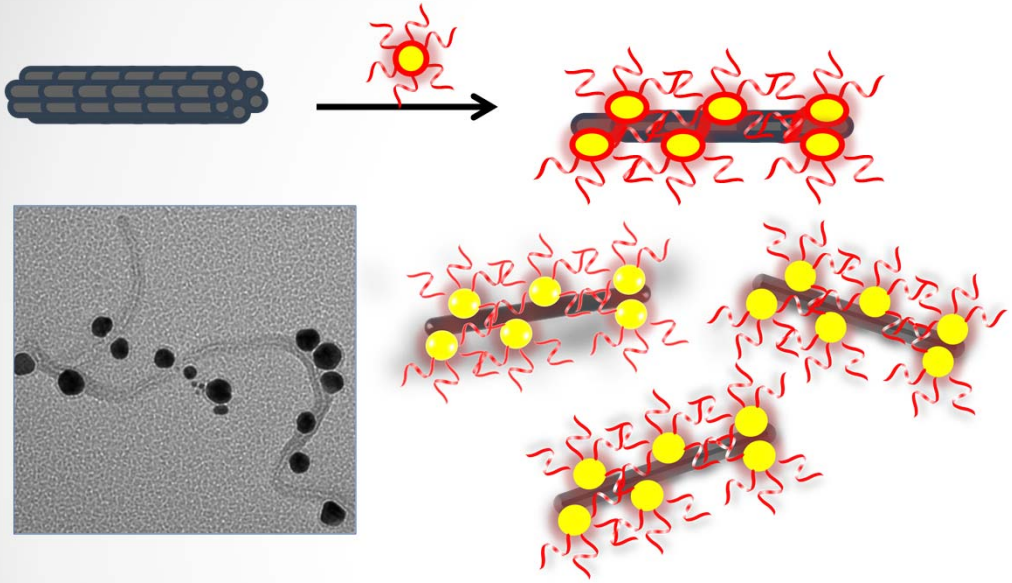




*Bioresour. Technol*. *101*, 812-817, (2010); *Chem. Eng. J*. *160*, 157-163, (2010); *J. Hazard. Mater*. *185*, 447-455 (2011).

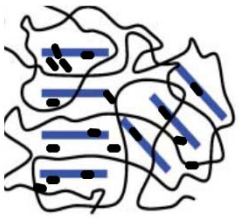
Dr. Mariana Pinteala
(pinteala@icmpp.ro)

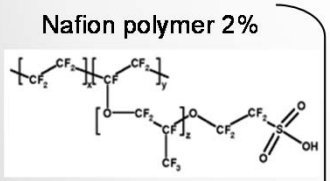
# Materiale avansate

## *DNA directed decoration of single-walled carbon nanotubes with gold nanoparticles*

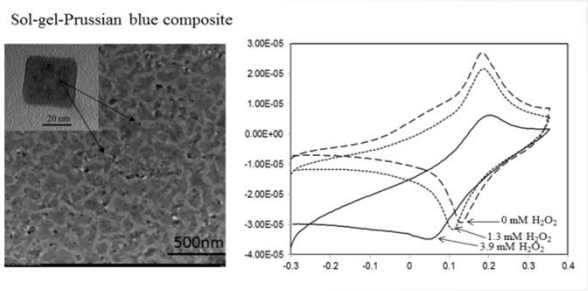




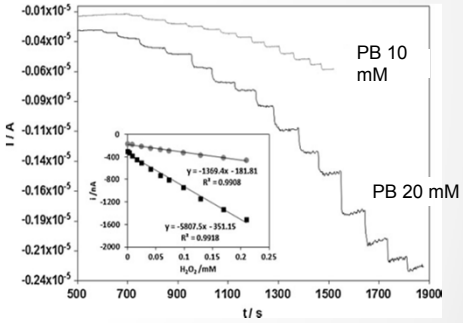




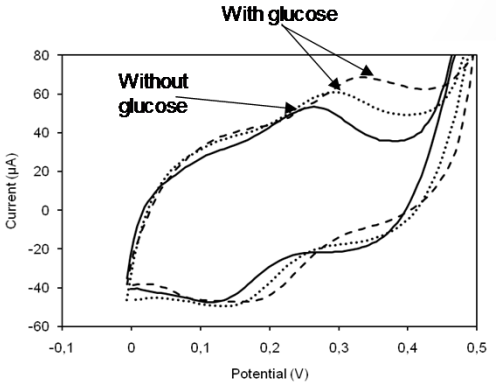

## *Electrochemical Reduction of Hydrogen Peroxide with Sol–gel–Prussian Blue composite electrode*




»Significant enhancement of sensor sensitivity and stability




*Microchim Acta 181, 111–120 (2014)*




» Increase of anodic current due to the oxidation of monosaccharides at CNT-NiCo-oxide composite electrode

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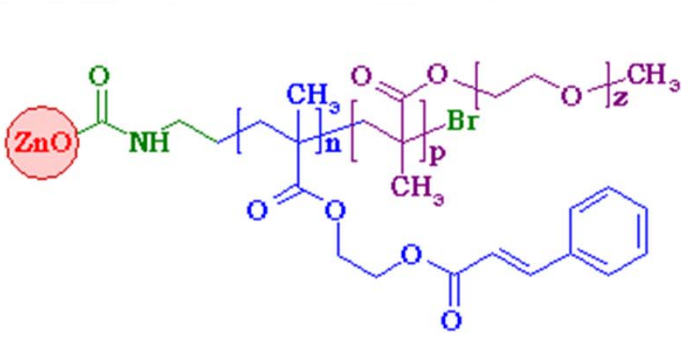
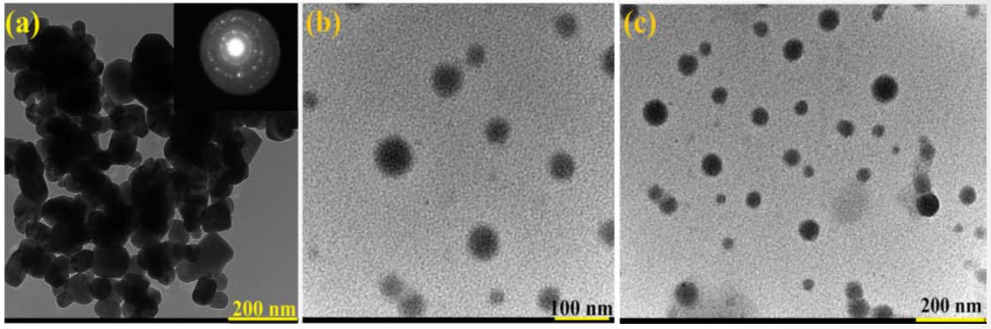
(emilbur@icmpp.ro)

Materiale avansate

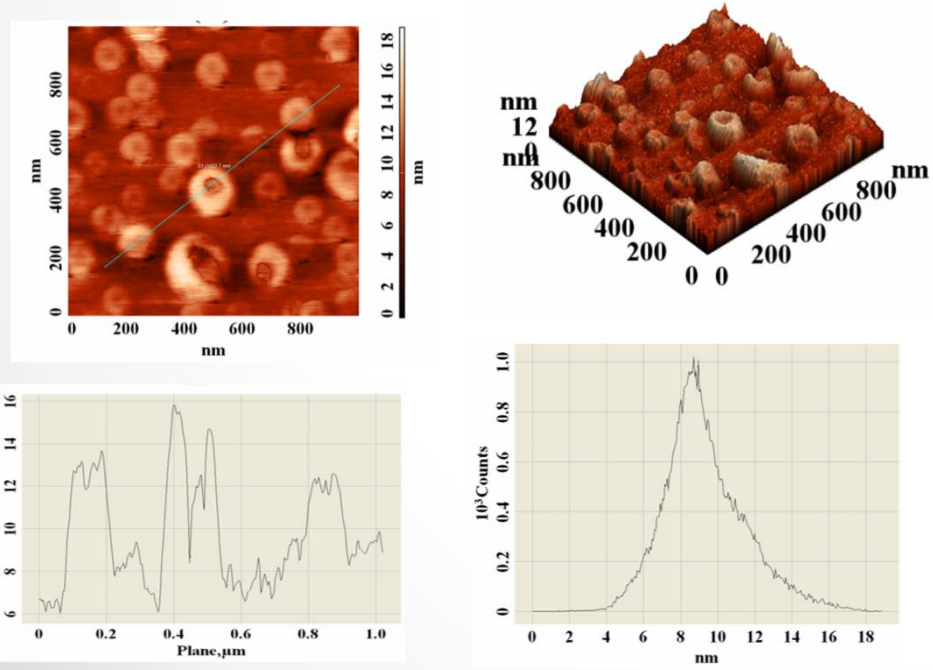
# Hybrid nanocomposites based on block copolymers with end-capped ZnO



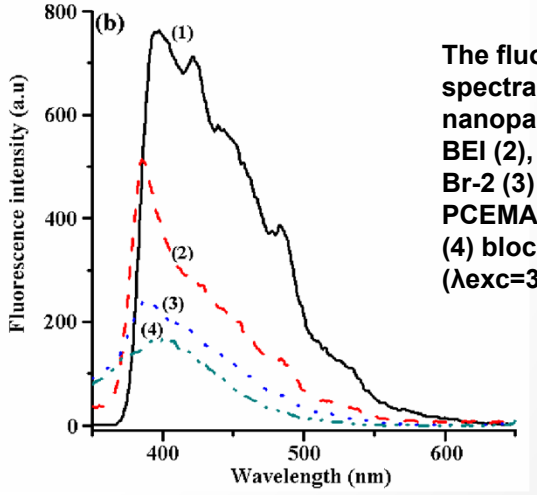

ZnO-PCEMA-b-PEGMA-Br




The TEM images of ZnO nanoparticles (a), ZnO-PCEMA-Br-2 (b) and ZnO-PCEMA-*b*-PEGMA-Br-2 polymer (c)




The AFM images of ZnO-PCEMA-*b*-PEGMA-Br-2 thin film



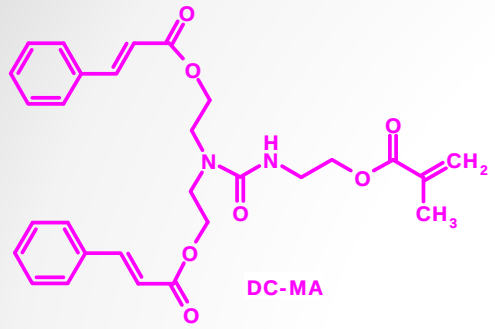

The fluorescence (b) spectra of ZnO nanoparticles (1), ZnO-BEI (2), ZnO-PCEMA-Br-2 (3) and ZnO-PCEMA-*b*-PEGMA-Br-2 (4) block copolymer (λexc=340 nm).

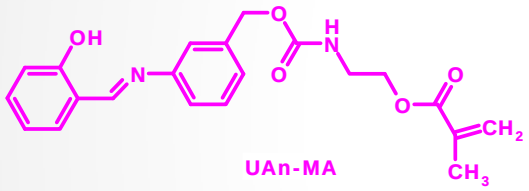
*Cent. Eur. J. Chem. 11, 1492-1504 (2013)*

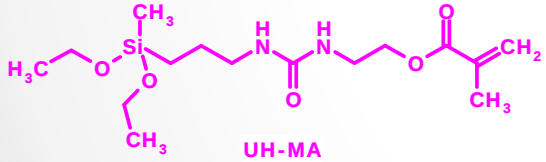
Dr. Emil Buruiana
(emilbur@icmpp.ro)

**Materiale avansate**

# Hybrid photopolymers structured by UV-light and femtosecond laser pulses



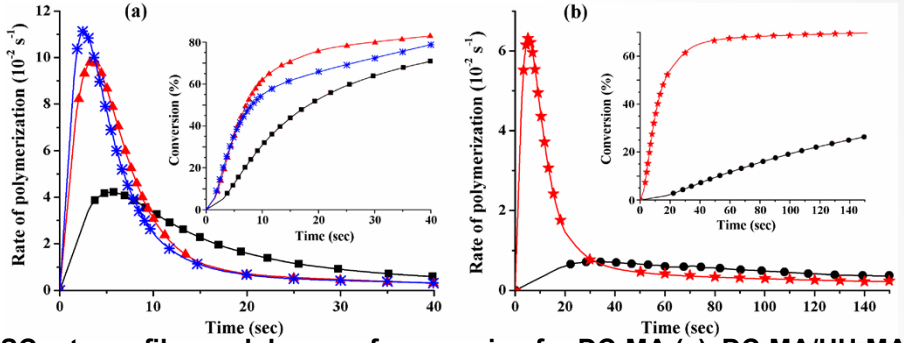
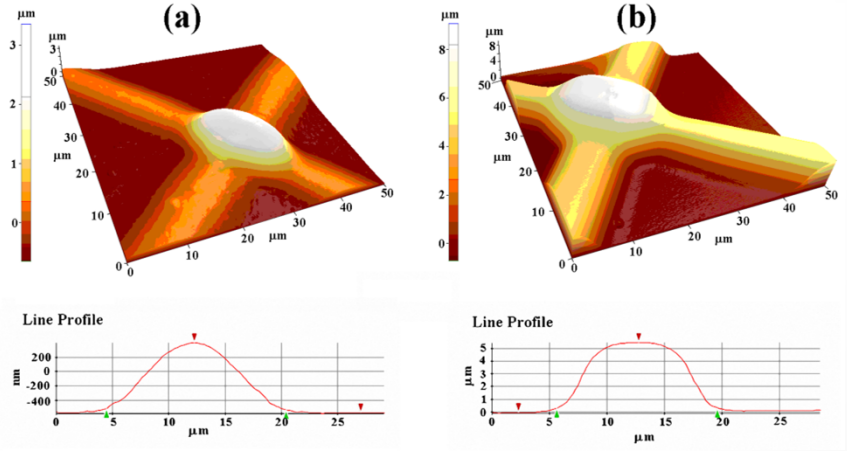
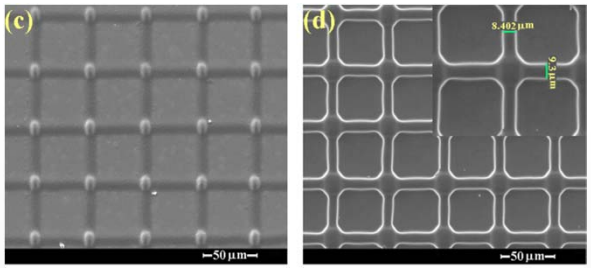




**Photo-DSC rate profiles and degree of conversion for DC-MA (■), DC-MA/UH-MA (▲), UH-MA (*) (a) and (b) for UAn-MA (●), UAn-MA/UH-MA (★)**




**AFM images for the structures obtained by 2PP method starting from DC-MA/UH-MA (a) and UAn-MA/UH-MA (b)**




**SEM images for 2D structures based on DC-MA/UH-MA (c) and UAn-MA/UH-MA (d) (distance between lines: 50 µm; scanning velocity: 3 mm/s)**

*Soft Mater. 11, 1-8 (2013)**

** With co-authors from INFLPR – Bucuresti*

# Aparatura disponibilă

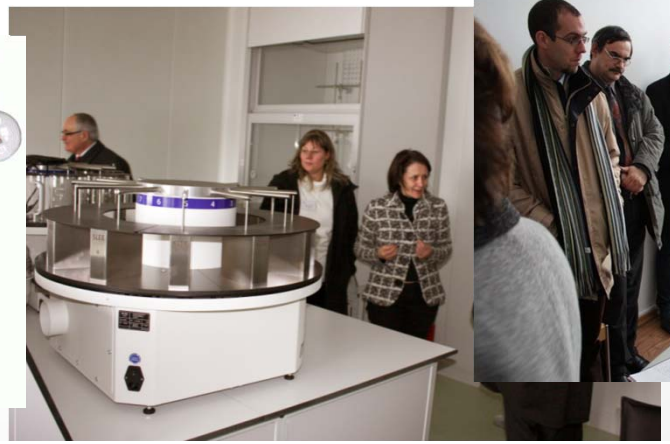
**Institutul este dotat cu echipamente de cercetare de ultimă generație la nivel european**

- **Preparare şi purificare/condiționare**

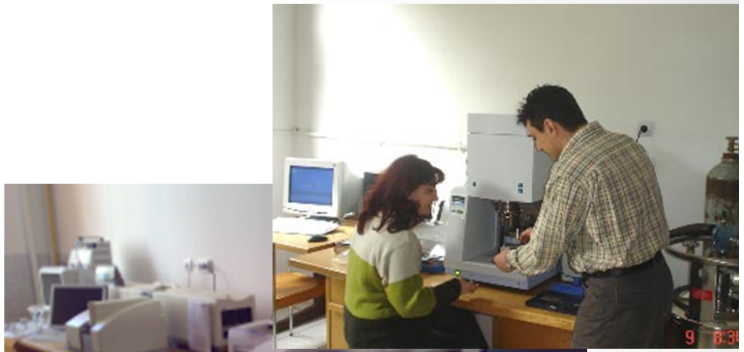
  **Aparatura uzuală pentru sinteza de polimeri şi compuşi organici;**
  **Instalaţie de filme subţiri prin depunere în stare de vapori sau prin "spin coating"**
  **Aparate de liofilizare**

- **Caracterizare de structură şi microstructură**

  **Spectrometre RMN, FTIR, Raman**
  **Microscopie TEM, SEM-EDAX, AFM**
  **Difractometre de raze X**



- **Analiză dimensională**
  **Zetasizer, Mastersizer, Elipsometru**
- **Proprietăți termice**
  **Analiza termogravimetricăa, Microcalorimetrie diferenţială**
- **Proprietăți optice**
  **Spectrometre UV-Viz, de fluorescenţă, Refractometre**
- **Proprietăți electrice**
  **Spectrometru dielectric, Electrometru**
- **Proprietăți reologice**
  **Reometre, Viscozimetre automate**



# Laboratoare acreditate

## Analiza şi caracterizarea nano- şi microparticulelor

- Laborator pentru testarea şi standardizarea materialelor polimerice nanometrice (dimensiune şi formă, aria suprafeței, dimensiunea porilor, densitate, chemisorptie şi potențial zeta)

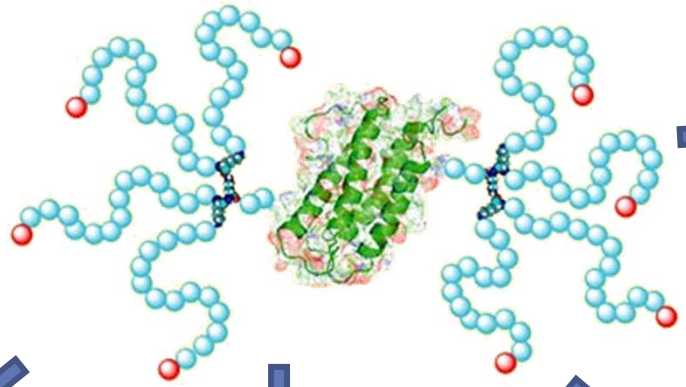
## Evaluarea si certificarea materialelor polimere pentru/din ambalaje

- ✓ Laborator pentru prelucrarea polimerilor (extruder, blender si mixer), analiza directă a reactiilor intermoleculare, determinarea grosimii filmelor ultra-subțiri, testare tracțiune/ compresie

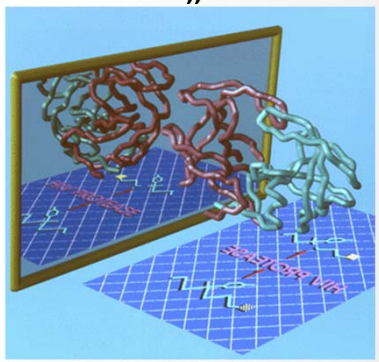
# CENTRU DE CERCETARI AVANSATE PENTRU BIONANOCONJUGATE SI BIOPOLIMERI

***IntelCentru***

## BIONANOCONJUGATE

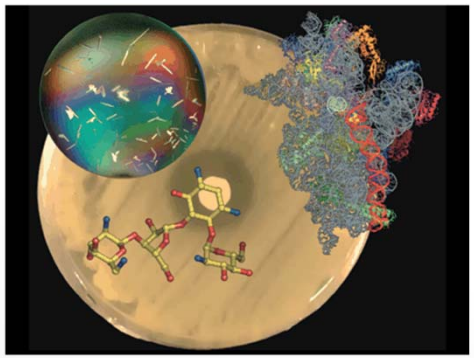


**Simulare si imagistica moleculara *„in silico"***

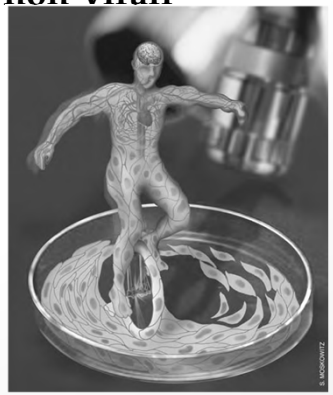


**Sinteza chimica si biosinteza**

**Investigatii la scara micro- si nano**



**Inginerie tisulara si vectori genetici non-virali**



# PARTICIPARE ÎN PROIECTE EUROPENE

- *FP3 – partener în 3 proiecte (COST – PECO, PECO – ERBIC – ICDCT, INCO – COPERNICUS – ERBIC)*
- *FP5 – partener în 5 proiecte (2 INTAS, 1 CRAFT, 2 GROWTH)*
- *FP6 – partener sau responsabil (peste 60 de parteneri şi un buget total de peste 1.2 mil. €)*
  - **Apeluri 2003:** *partener în 3 NoE, 1 IP, 1 Marie Curie Tok)*
  - **Apeluri 2004:** *coordonator al proiectului RAINS; partener în 1 IP*
- *FP7 – partener în 5 proiecte*
- *COST – manager national în 6 Acţiuni COST*
- *FONDURI STRUCTURALE - 3 proiecte*


epnoe
European Polysaccharide Network Of Excellence

Sixth Framework Programme
Romanian Action for Integrating, Networking and Strengthening the European Research Area
RAINS

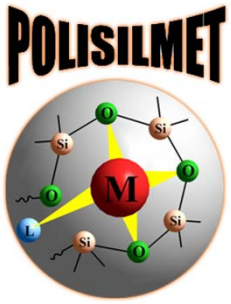
# Participări în proiecte PC 7

- **Added-value from chemicals and polymers by new integrated separation, fractionation and upgrading technologies** (AFORE), FP7-NMP-2008-LARGE-2-228589 (Dr. Iuliana Spiridon)
- **Bioactive highly porous and injectable scaffolds controlling stem cell recruitment proliferation and differentiation and enabling angiogenesis for cardiovascular engineered tissues** (BIOSCENT), FP7-NMP-2007-LARGE-1-214539 (Dr. Constantin Ciobanu)
- **Mechanisms of interactions in nano-scale of novel ionic lubricants with functional surfaces** (MINILUBES), FP7-PEOPLE-2007-1-1-ITN-216011-2 (Acad. Bogdan C. Simionescu)
- **Strengthening the Romanian research capacity in Multifunctional Polymeric Materials** (STREAM), FP7-REGPOT-2010-1-264115 (Dr. Valeria Harabagiu)




# Participări în proiecte finanţate din fonduri structurale

- Fondul Social European – **Program de burse postdoctorale „Cristofor I. Simionescu**", POSDRU/89/1.5/S/55216 (Acad. Bogdan C. Simionescu)
- POSCCE: **Sinteza si studiul metalosiloxanilor polimerici – noi materiale de interes pentru cataliza si nanostiinte** (POLISILMET), ID 570, Cod SMIS – CSNR: 12473- 129/2010 (Dr. Maria Cazacu)
- POSCCE: **Centru de Cercetări Avansate pentru Bionanoconjugate şi Biopolimeri, IntelCentru** – ID 88, Nr. 03/01.03.2009; CodSMIS – CNRS 2213 (Dr. Mariana Pinteală)


# COOPERARE INTERNAŢIONALĂ

- **ICMPP are legături de colaborare ştiinţifică cu institute şi universităţi din Europa, Japonia, China, USA şi Canada.**

# Institutul de Chimie Macromoleculară "Petru Poni" al Academiei Romane

## Cercetare fundamentală de excelenţă şi orientări aplicative

Romanian Academy

PETRU PONI

*Simpozionul "De la excelenţă la competitivitate: tehnologiile generice esenţiale"*

**15 mai 2014 , Aula Academiei Române**