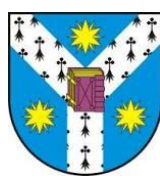
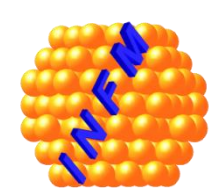


# Știința suprafețelor și interfețelor: fizică, chimie, biologie, aplicații

**Director de Proiect: CS I Dr. Cristian M. Teodorescu**

*Institutul Național de C-D pentru Fizica Materialelor  
București Măgurele  
e-mail [teodorescu@infim.ro](mailto:teodorescu@infim.ro)*



CO: Institutul Național de C-D pentru Fizica Materialelor Măgurele

- (i) grup Suprafețe și Interfețe (CS I Dr. Cristian M. Teodorescu)
- (ii) grup Heterostructuri (CS I Dr. Lucian Pintilie)
- (iii) grup Nanostructuri bazate pe Si și Ge (CS I Dr. Magdalena L. Ciurea)

P1: Institutul Național de C-D pentru Inginerie Electrică București (CS I Dr. Jenica Neamțu)

P2: Universitatea de Medicină și Farmacie "Carol Davila" București,  
Facultatea de Biofizică (CS II Dr. Tudor Savopol)

P3: Universitatea "Alexandru Ioan Cuza" Iași

- (i) Fizica Plasmei (Prof. Dr. Dumitru Luca)
- (ii) Materiale feroelectrice (Prof. Dr. Liliana Mitoșeriu)

P4: Institutul Național de C-D pentru Fizică Tehnică Iași (CS II Dr. Nicoleta Lupu)

P5: Institutul Național de C-D pentru Tehnologii Izotopice și Moleculare Cluj-Napoca

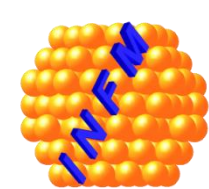
- (i) Sisteme Nanostructurate (CS I Dr. Ovidiu Pană)
- (ii) Fizică Moleculară și Biomoleculară (CS I Dr. Ioan Turcu)

P6: Universitatea "Babeș-Bolyai" Cluj-Napoca, Institutul de Studii Interdisciplinare  
(Prof. Dr. Simion Șimon)

P7: Academia Română - Filiala Timișoara

- (i) Simulări prin metoda "lattice Boltzmann" (CS II Dr. Victor Sofonea)
- (ii) Nanofluide Magnetice (+ UP Timișoara, Conf. Dr. Floriana Stoian)

P8: Universitatea de Medicină și Farmacie "Victor Babeș" Timișoara,  
Facultatea de Biofizică (Prof. Dr. Adrian Neagu)



Obiectivul principal (managerial, strategic) al Proiectului:

**OM-S: Cristalizarea, formarea și direcționarea activităților de științe ale suprafețelor și interfețelor în România, prin evitarea suprapunerilor, eficientizarea utilizării resurselor și intensificarea colaborărilor între principalii actori implicați.**

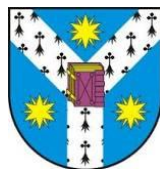
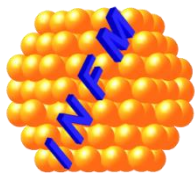
### Obiective Generale:

**OG1: Evidențierea rolului predominant al interacțiunilor la nanoscală între proprietățile fizice distincte ale noilor materiale.**

**OG2: Evidențierea fenomenelor specifice de chimie a suprafețelor și interfețelor și orientarea acestor fenomene noi spre aplicații cu impact ridicat**

**OG3: Funcționalizarea unor suprafețe de interes biologic prin metode specifice științei suprafețelor – optimizarea procedurilor chemo/electrochemoterapeutice, de regenerare tisulară, de separare și micro/nanomanipulare a celulelor**

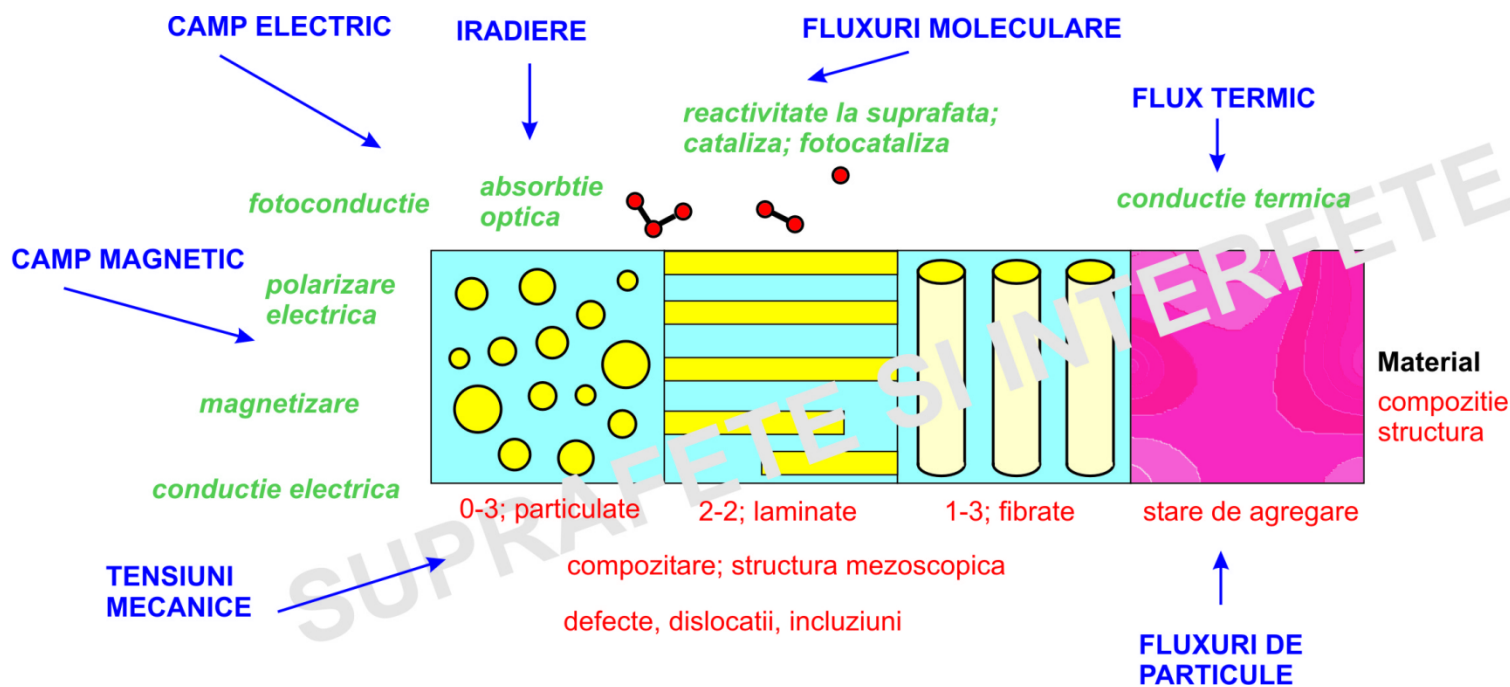
**OG4: Propunerea de metode noi de standardizare în metodele de măsură specifice științei suprafețelor.**



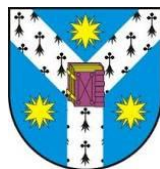
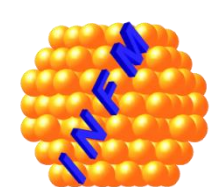
*OG1-D1: Punerea în evidență a câtor mai multe cuplaje între fenomene fizico-chimice, cu evidențierea rolului suprafețelor și interfețelor.*

*OG1-D2: Elucidarea mecanismelor intime, legate de suprafețe și interfețe, care stau la baza câtor mai multe fenomene de puternic interes aplicativ în momentul de față.*

*OG1-D3: Identificarea aplicațiilor de noutate absolută, propunerea de structuri și dispozitive în vederea realizării acestor aplicații. Proprietate intelectuală, identificare de potențiali beneficiari.*



*Povești despre IDEI complexe și oameni de succes - București 12 decembrie 2013*



*OG2-D1: Studii fundamentale de natură a elucida multitudinea de fenomene asociate chimiei suprafețelor.*

*OG2-D2: Propunerea de noi tehnologii și aplicații, cercetare orientată spre elaborarea de noi produse, metode și concepte implicând noile fenomene identificate și cuantificate.*

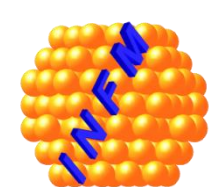
OG3-D1. Nanoparticule magnetice functionalizate pentru separare magnetică sau recunoaștere moleculară.

OG3-D2. Caracterizarea atașării celulelor pe substraturi biocompatibile.

OG3-D3. Studiul autoasamblării unor structuri biologice pe suprafețe.

OG3-D4. Modificarea suprafeței celulelor în condiții patologice.

**OG4: Propunerea de metode noi de standardizare în metodele de măsură specifice științei suprafețelor: spectroscopie XPS, Auger, difracție de raze X și de electroni, tehnici asociate.**



Indicatori de rezultat	Angajat	Realizat
Articole în reviste cotate ISI	71	85
Factor de impact total*	100	132,799
Brevete depuse	4	4
Articole în reviste cu FI ridicat (peste 3)	-	9

\*normat la numărul de proiecte, în cazul menționării mai multor surse de finanțare

*Adv. Funct. Mater., Chem. Mater., Phys. Rev. B, Appl. Phys. Lett., Bioelectrochemistry, J. Phys. Chem (A & C), J. Appl. Crystallogr., J. Nanopart. Res.*

### Noi colaborări internaționale:

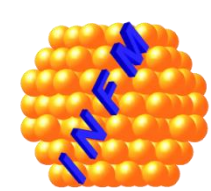
2 proiecte IFA-CEA: C1-08 (C.M. Teodorescu) și C1-09 (L. Pintilie)

1 **Integrated Project FP7** "Interfacing oxides" (IFOX; partener RO: L. Pintilie)

2 proiecte ANR-ANCS 2012 (V. Sofonea și C.M. Teodorescu)

2 proiecte de utilizare a radiației de sincrotron la Elettra Trieste (Pintilie, Teodorescu)

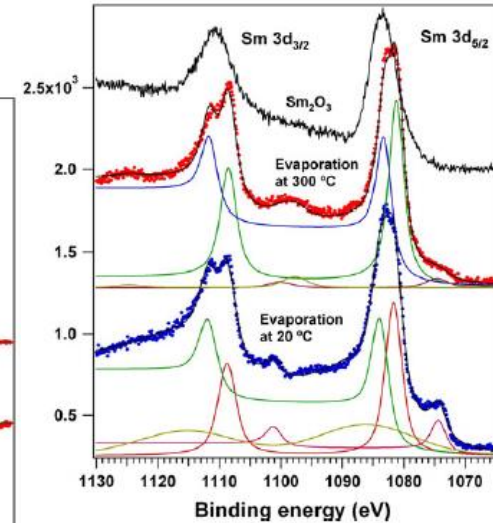
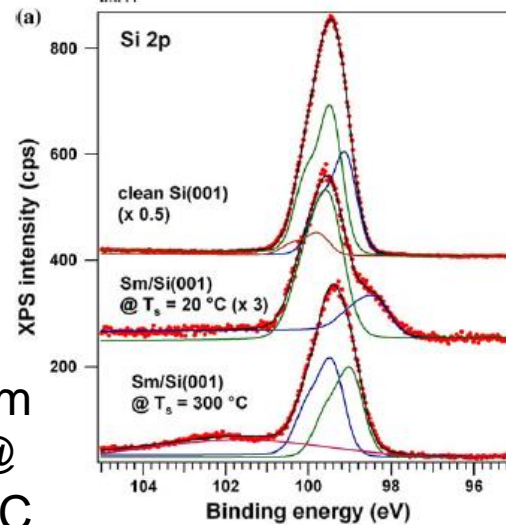
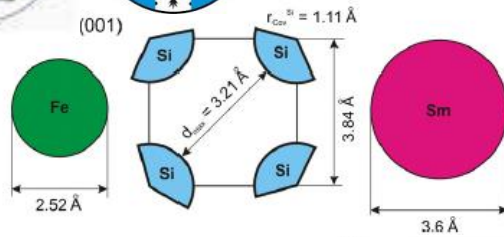
*Povești despre IDEI complexe și oameni de succes - București 12 decembrie 2013*



# Sm/Si(001)

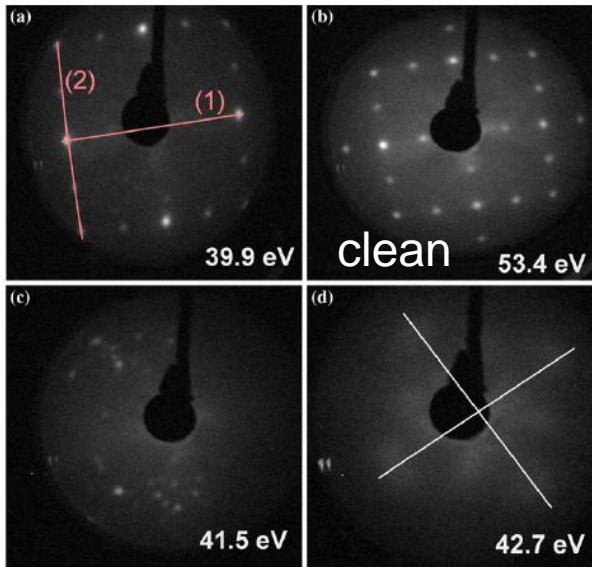
# Magnetismul Suprafețelor

## XPS



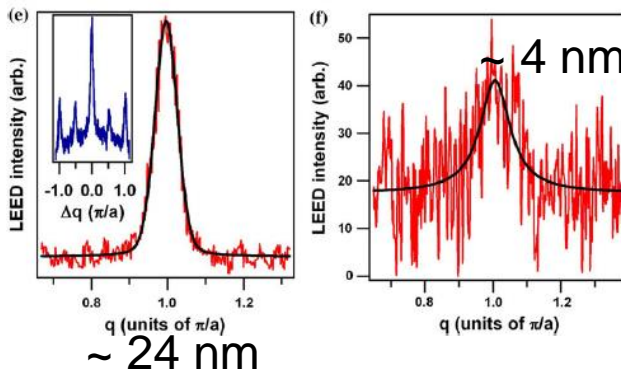
## LEED

Si(001)  
curat



3.3 nm  
Sm @  
100 °C

3.3 nm  
Sm @  
300 °C



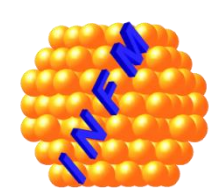
Level	Room temperature deposition					High temperature (300 °C) deposition				
	Energy (eV)	A (eV × kcps)	A <sub>corr</sub> (eV × kcps)	SOS (eV)	IBF (eV <sup>-1</sup> )	Energy (eV)	A (eV × kcps)	A <sub>corr</sub> (eV × kcps)	SOS (eV)	IBF (eV <sup>-1</sup> )
Si 2p (i)	98.37	0.16	0.59	0.6	0.0195	98.97	0.90	3.34	0.6	0*
Si 2p (ii)	99.49	0.60	2.22	0.6	0*	99.43	0.98	3.63	0.6	0.024
Sm 3d (i)	1074.33	1.33	0.27	26.85	0.058	1074.58	0.53	0.11	25.55	0*
Sm 3d (ii)	1081.67	6.97	1.39	27.07	0*	1081.22	7.99	1.60	27.3	0.008
Sm 3d (iii)	1083.83	4.99	1.00	27.96	0.106	1083.17	5.17	1.03	28.41	0.117

\* Below 10<sup>-4</sup> cps/eV

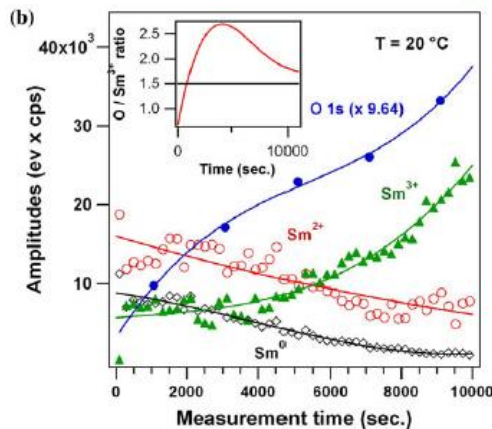
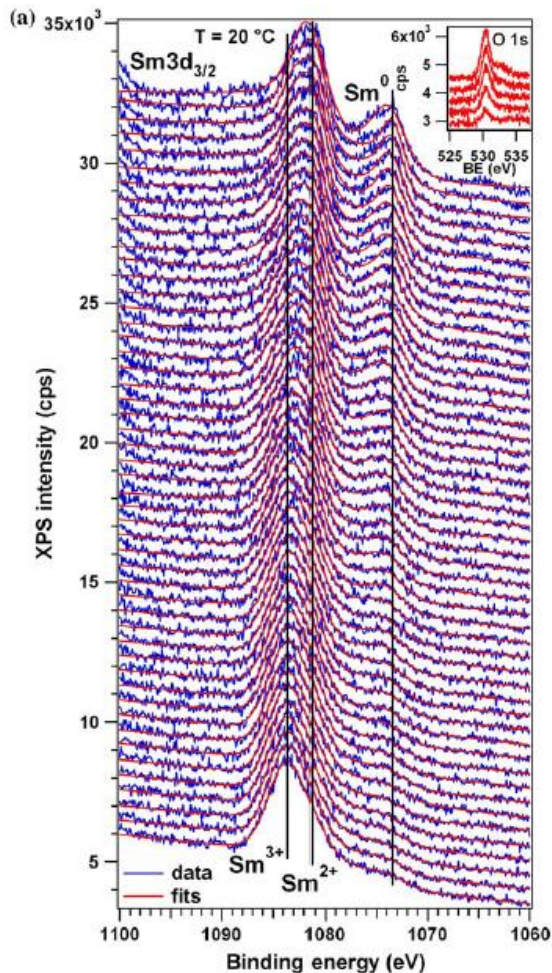
100 °C : 0.1 SmSi<sub>2</sub> + 0.4 Sm<sub>4</sub>Si<sub>3</sub> + 0.4 Sm

300 °C: 0.7 SmSi<sub>2</sub> + 0.3 Sm<sub>4</sub>Si<sub>3</sub>

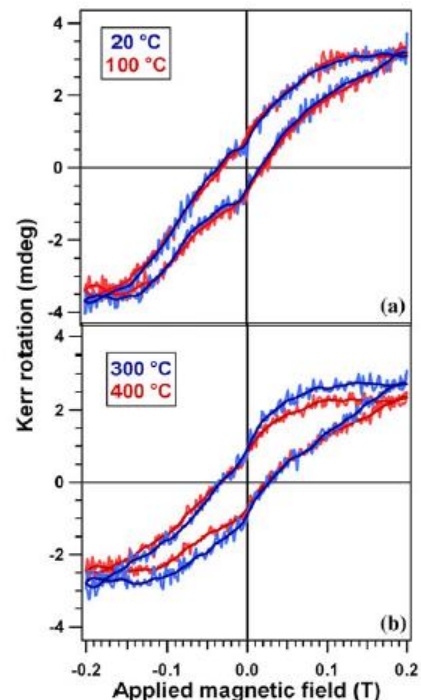
NOU: SOS = f(q); atribuire Sm<sup>0</sup>, Sm<sup>2+</sup>, Sm<sup>3+</sup>



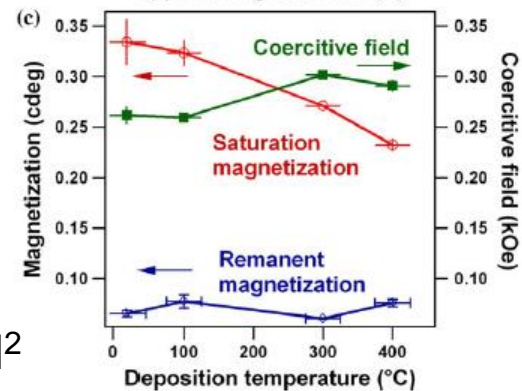
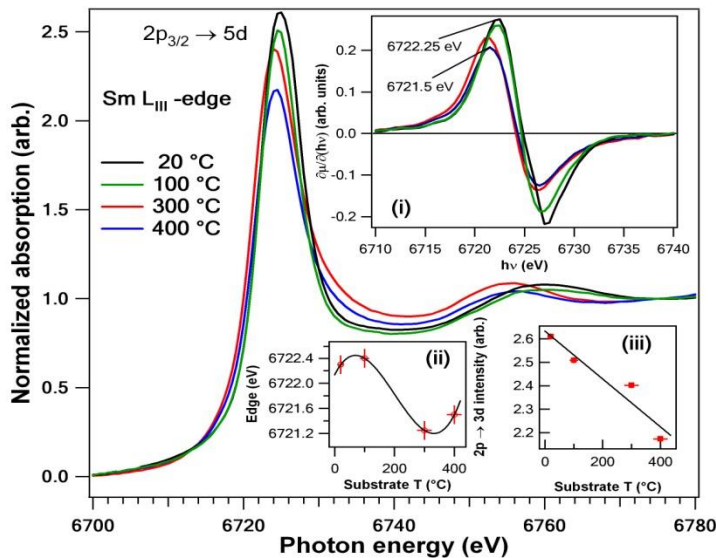
# Studii de oxidare *in-situ*:



# RT MOKE:



# XANES:

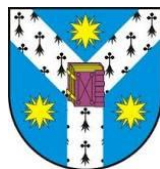
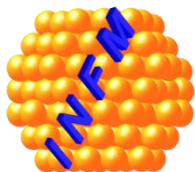


Faza feromagnetică:  $Sm_4Si_3$  with  $\sim 2.5 \mu_B/Sm$

R.M. Costescu *et al.*, J. Mater. Sci. **47**, 7225 (2012)

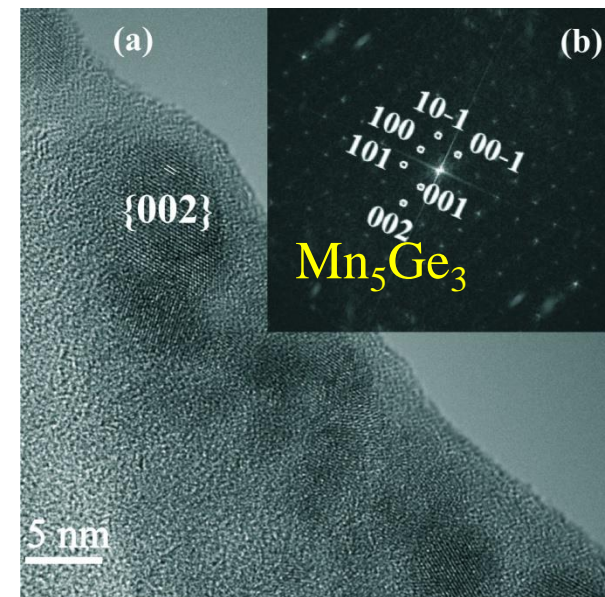
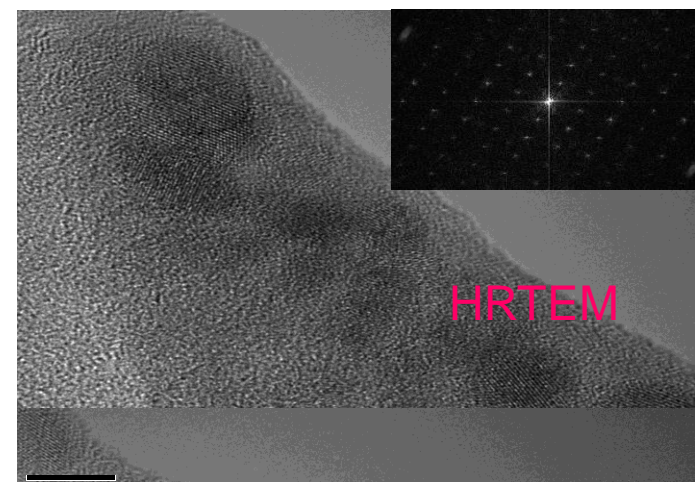
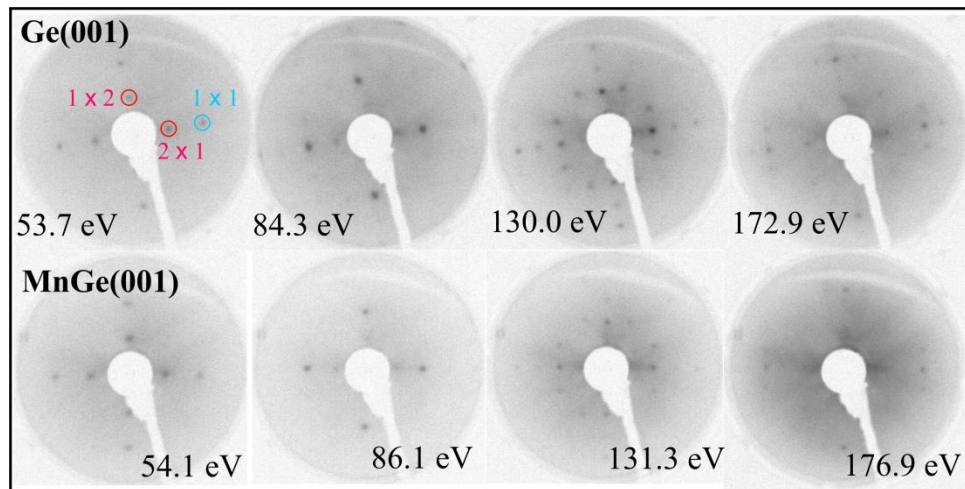
N.G. Gheorghe *et al.* Appl. Surf. Sci. **267**, 106 (2013)



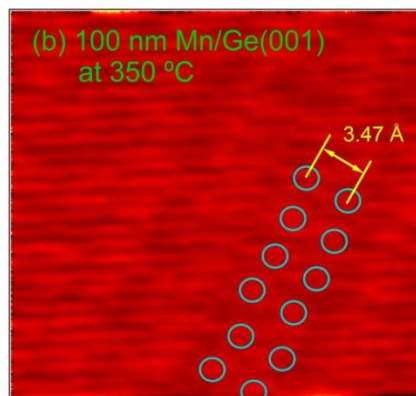
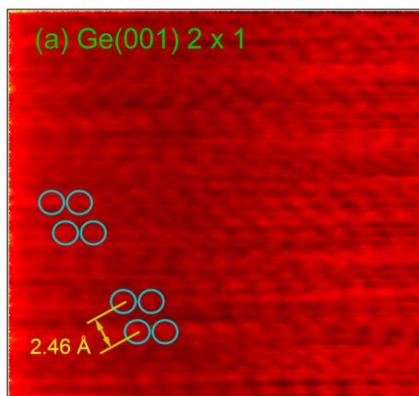


Semiconductori diluați feromagnetici - Ge(001):Mn

LEED: suprafața Ge(001) (2 x 1) - (1 x 2) neafectată

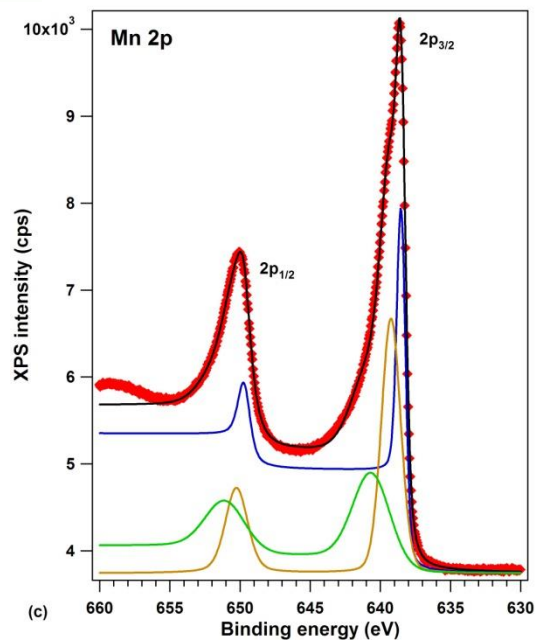
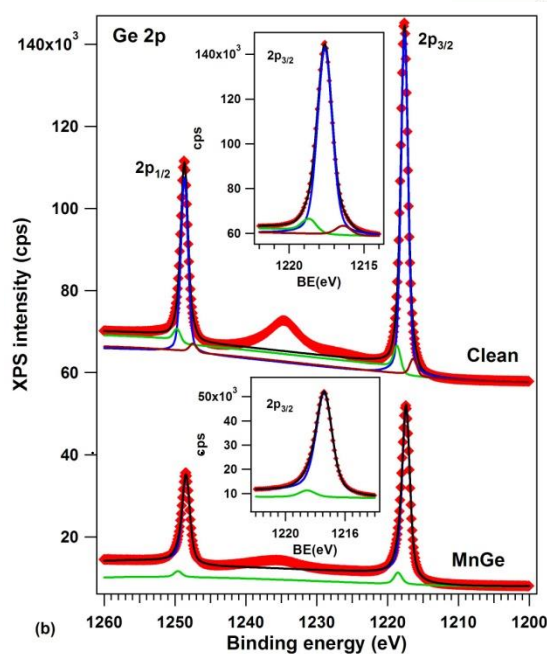
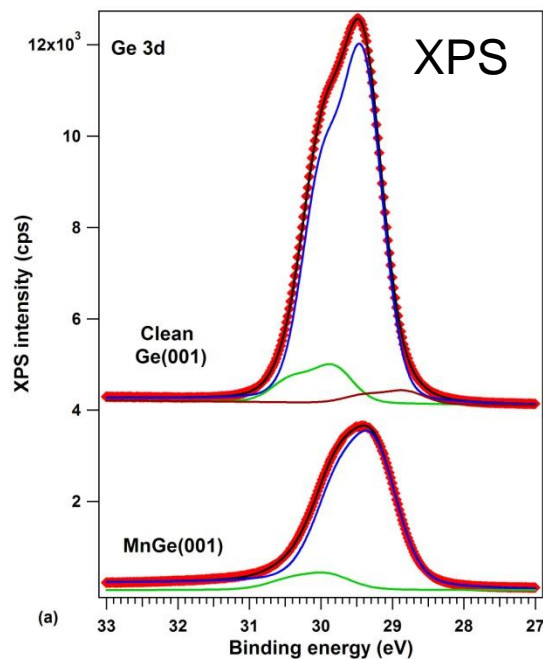
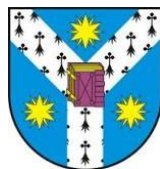
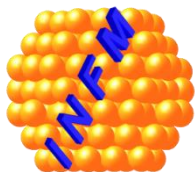


STM

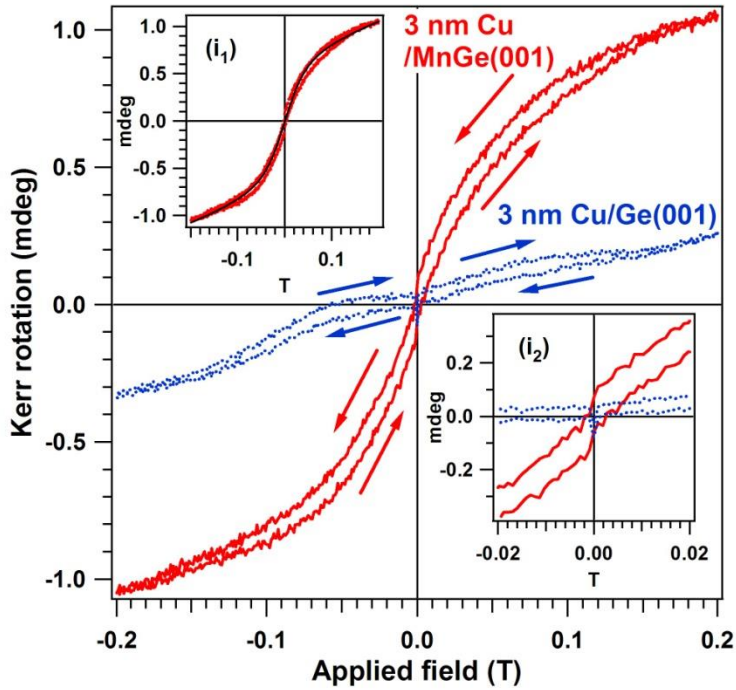
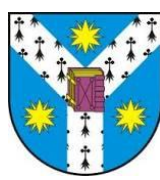
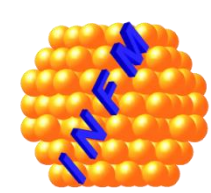


Povești despre IDEI complexe și oameni de succes  
 - București 12 decembrie 2013

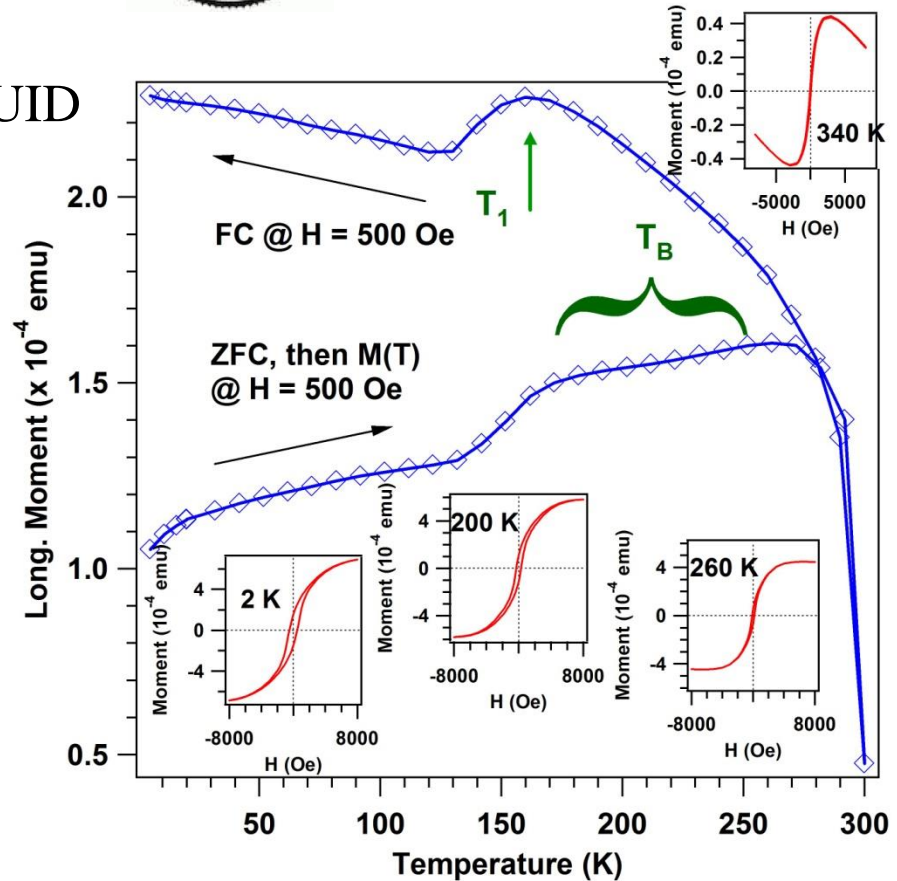
G.A. Lungu *et al.*, *Materials*, *accepted* (2013)



Sample	Level	Ge 3d			Ge 2p			Mn 2p		
	Component	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
clean Ge(001) (2 x 1)	BE <sub>j</sub> <sub>max</sub> (eV)	29.413	29.829	28.820	1217.62	1218.64	1216.37	-	-	-
	A(eVkcps)	8.70	0.94	0.33	175.42	12.36	9.43	-	-	-
	A <sub>corr</sub> (eVkcps)	22.89	2.47	0.87	19.17	1.35	1.03	-	-	-
	A <sub>corr, total</sub>	26.23			21.55			-		
MnGe (001)	BE <sub>j</sub> <sub>max</sub> (eV)	29.243	29.886	-	1217.40	1218.55	-	638.50	639.24	640.61
	A(eVkcps)	4.33	0.49	-	110.66	7.52	-	4.29	7.64	5.87
	A <sub>corr</sub> (eVkcps)	11.39	1.29	-	12.09	0.82	-	1.65	2.94	2.26
	A <sub>corr, total</sub>	12.68			12.91			6.85		



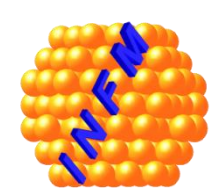
## SQUID



## Componente:

- superparamagnetică ( $12,000 \mu_B$ )  $\rightarrow$   $Mn_5Ge_3$  și  $Mn_{11}Ge_8$
- ferromagnetică  $\rightarrow$  Mn diluat în Ge(001)  $\rightarrow$  DMS
- paramagnetică ( $5 \mu_B$ )  $\rightarrow$  Mn metal în vecinătatea suprafeței

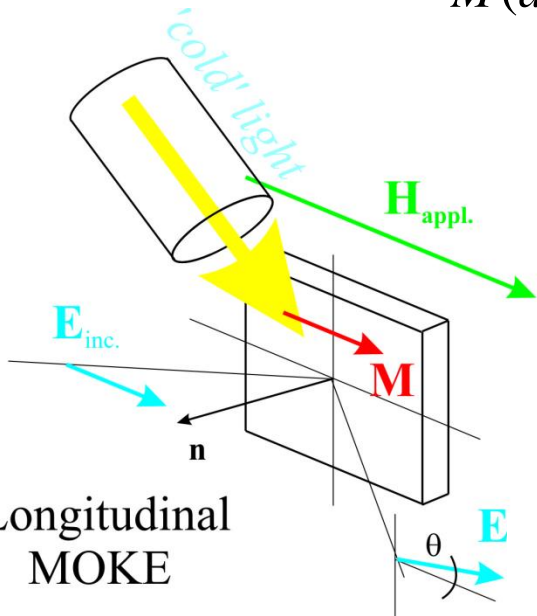
G.A. Lungu *et al.*,  
Materials, *accepted*



# Controlul optic al magnetizării în Ge(001):Mn

RKKY:

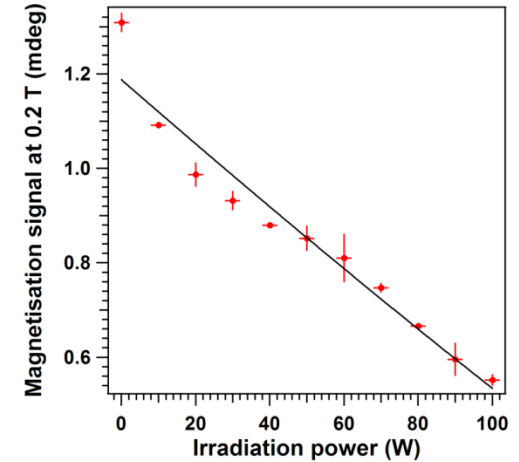
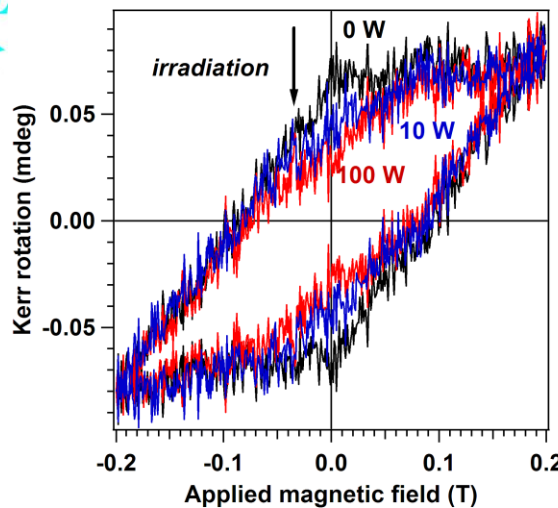
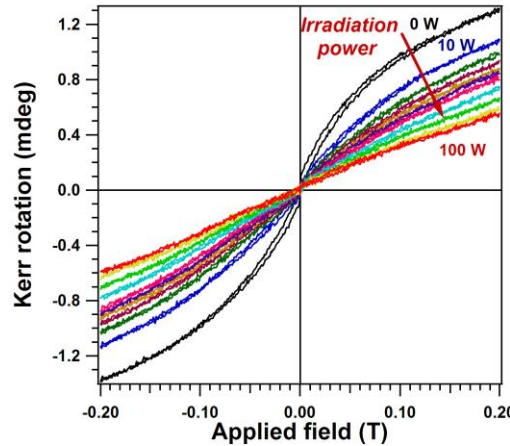
$$M(a,b,c,P) = a * \frac{\sin[2\pi \cdot (b + c \cdot P)^{1/3}]}{\sin[2\pi \cdot b^{1/3}]}$$



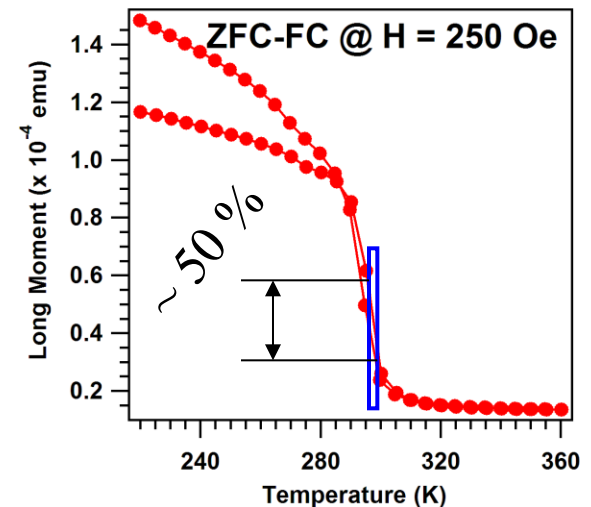
Longitudinal MOKE

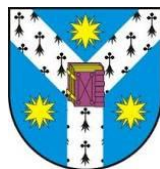
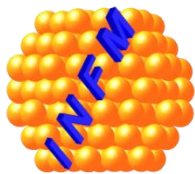
C.A. Tache, I.C. Bucur et al., unpublished

Componenta FM afectată de iradiere

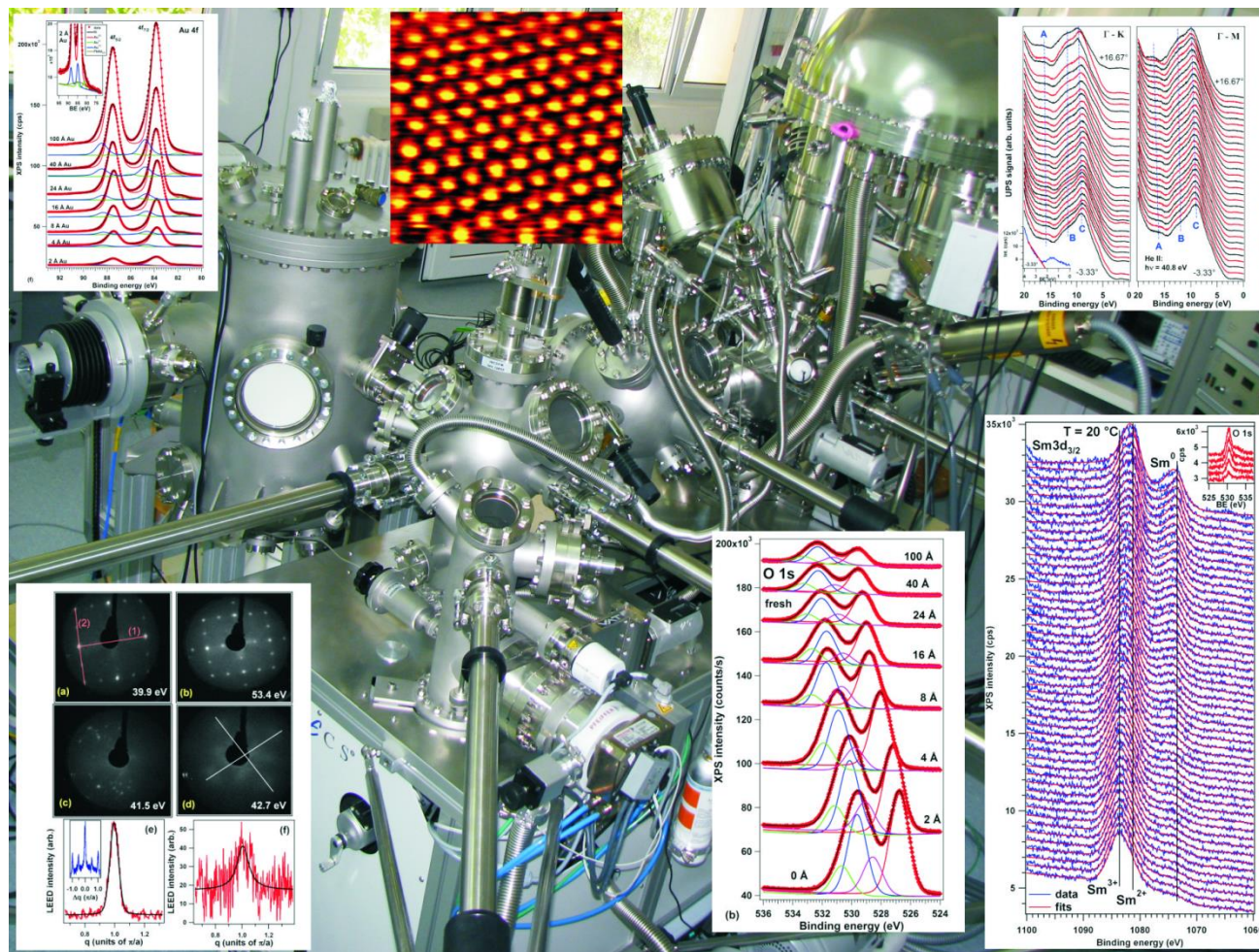


$$\Delta T_{meas.} = 3 \text{ K}$$





# MBE, STM, spectroscopie de fotoelectroni: cluster de știința suprafețelor

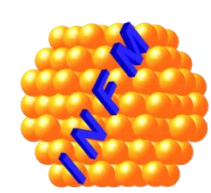


Tehnici experimentale:

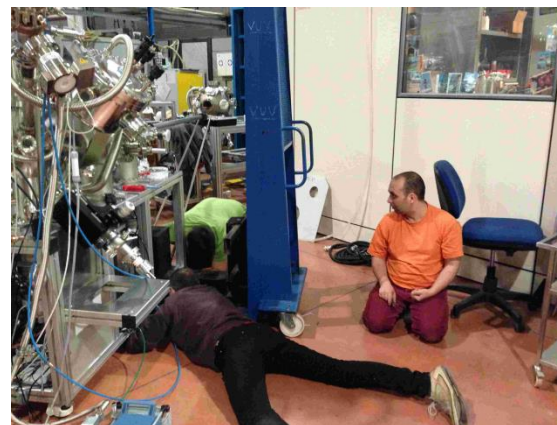
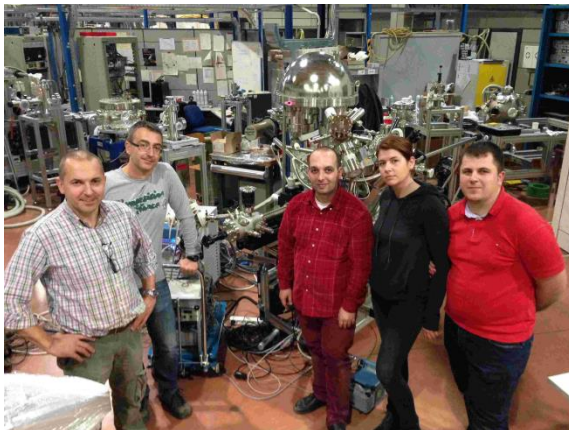
**MBE:** LEED, RHEED, AES, SIMS, RGA, TDA

**STM:** STM, STS

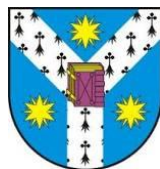
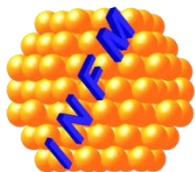
**PES:** XPS, XPD, AES  
UPS, ARUPS, SR-UPS, MEIS, EELS



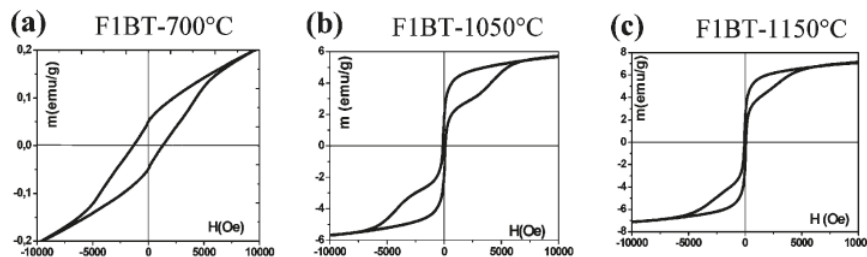
... mutată la Elettra Trieste (SuperESCA)



*Povești despre IDEI complexe și oameni de succes - București 12 decembrie 2013*



*Chem. Mater.* **2010**, *22*, 4740–4748  
DOI:10.1021/cm1011982

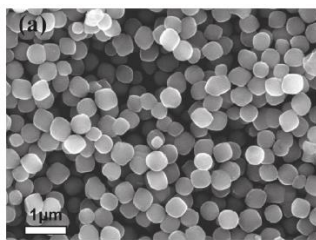
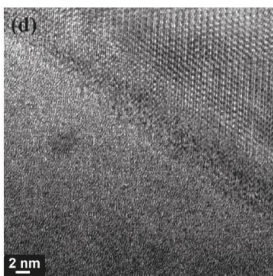


**CHEMISTRY OF MATERIALS**  
Article

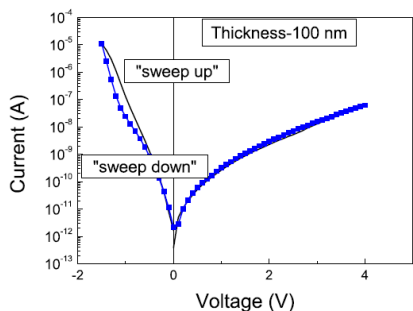
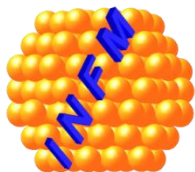
## Fe<sub>2</sub>O<sub>3</sub>@BaTiO<sub>3</sub> Core–Shell Particles as Reactive Precursors for the Preparation of Multifunctional Composites Containing Different Magnetic Phases

Maria Teresa Buscaglia,<sup>†</sup> Vincenzo Buscaglia,<sup>\*,†</sup> Lavinia Curecheriu,<sup>‡</sup>  
Petronel Postolache,<sup>‡</sup> Liliana Mitoseriu,<sup>‡</sup> Adelina C. Ianculescu,<sup>§</sup> Bogdan S. Vasile,<sup>§</sup>  
Zhao Zhe,<sup>#</sup> and Paolo Nanni<sup>†,○</sup>

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*Povești despre IDEI complexe și oameni de succes  
- București 12 decembrie 2013*



PHYSICAL REVIEW B 82, 085319 (2010)

## Ferroelectric Schottky diode behavior from a $\text{SrRuO}_3\text{-Pb}(\text{Zr}_{0.2}\text{Ti}_{0.8})\text{O}_3\text{-Ta}$ structure

Lucian Pintilie,\* Viorica Stancu, L. Trupina, and Ioana Pintilie

National Institute of Materials Physics, P.O. Box MG-7, Bucharest-Magurele 077125, Romania

research papers

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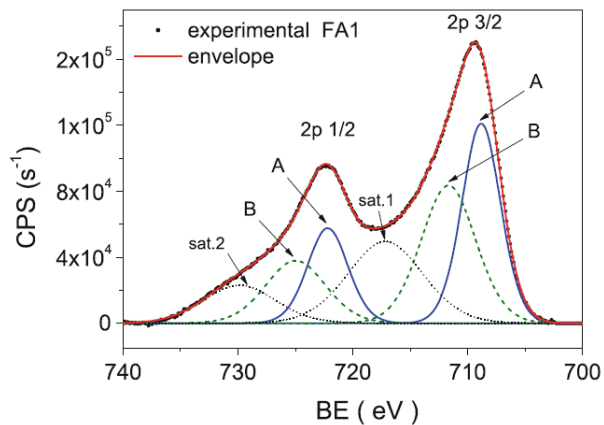
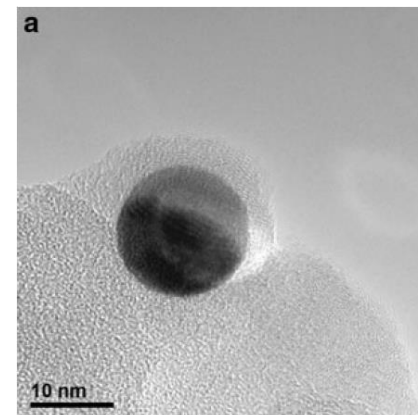
## New analytical approximation of diffraction size broadened peak profile for spherical crystallites with a lognormal distribution

N. C. Popa,\* C. M. Teodorescu and S. Frunza

National Institute of Materials Physics Bucharest, Atomistilor 105b, PO Box MG-7, 077125, Magurele-Ifov, Romania. Correspondence e-mail: nicpopa@infim.ro

J Nanopart Res (2011) 13:6181–6192

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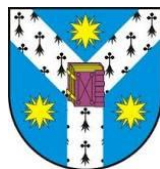
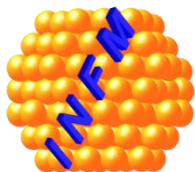
SPECIAL ISSUE: NANOSTRUCTURED MATERIALS 2010

## Comparative study of core-shell iron/iron oxide gold covered magnetic nanoparticles obtained in different conditions

C. Leostean · O. Pana · R. Turcu · M. L. Soran ·  
S. Macavei · O. Chauvet · C. Payen

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# Bioelectrochemistry

journal homepage: [www.elsevier.com/locate/bioelechem](http://www.elsevier.com/locate/bioelechem)



## Interaction of gentamicin polycation with model and cell membranes

Eugenia Kovács<sup>a</sup>, Tudor Savopol<sup>a,\*</sup>, Maria-Minodora Iordache<sup>a</sup>, Lavinia Săplăcan<sup>a</sup>, Iuliana Sobaru<sup>a</sup>,  
Claudia Istrate<sup>a</sup>, Marie-Paule Mingeot-Leclercq<sup>b,1</sup>, Mihaela-Georgeta Moisescu<sup>a</sup>

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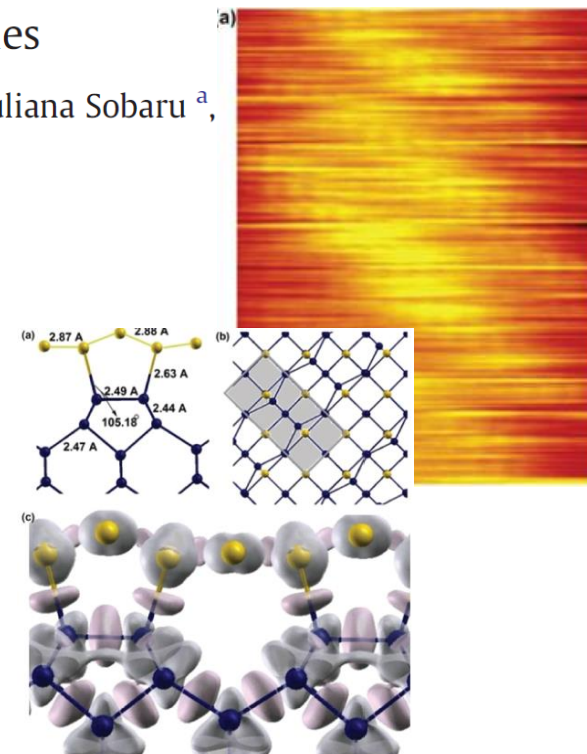
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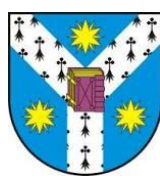
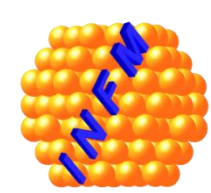
## Au-Ge bonding on a uniformly Au-covered Ge(001) surface

Dana G. Popescu and Marius A. Husanu\*

National Institute of Materials Physics, P.O. Box MG7, Bucharest-Magurele 077125, Romania



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## Interface charge transfer in polypyrrole coated perovskite manganese magnetic nanoparticles

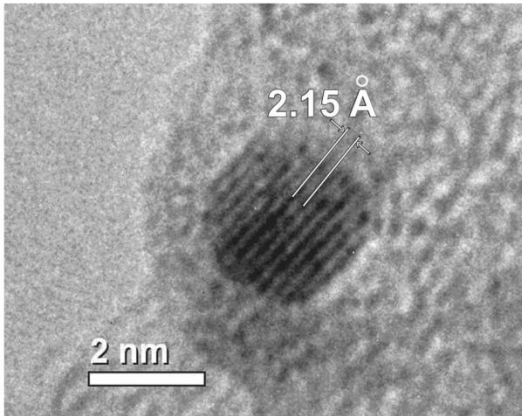
O. Pana,<sup>1</sup> M. L. Soran,<sup>1,a)</sup> C. Leostean,<sup>1</sup> S. Macavei,<sup>1</sup> E. Gautron,<sup>2</sup> C. M. Teodorescu,<sup>3</sup> N. Gheorghe,<sup>3</sup> and O. Chauvet<sup>2</sup>

<sup>1</sup>National Institute for R&D of Isotopic and Molecular Technologies, PO Box 700, 400293 Cluj-Napoca, Romania

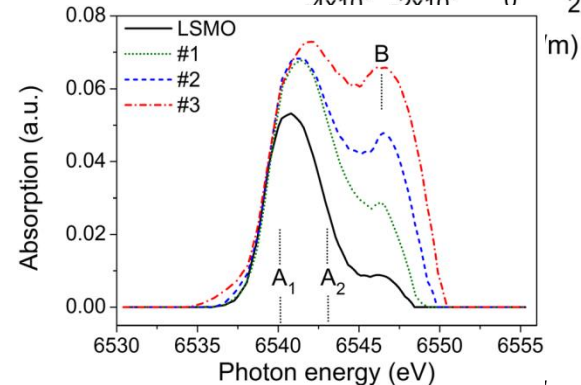
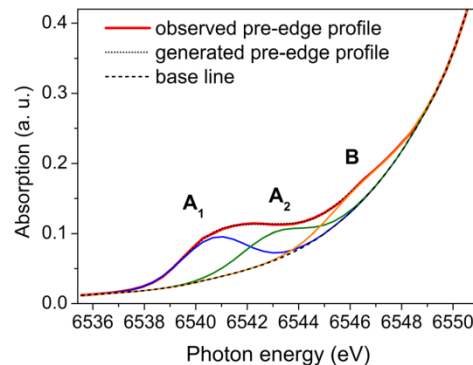
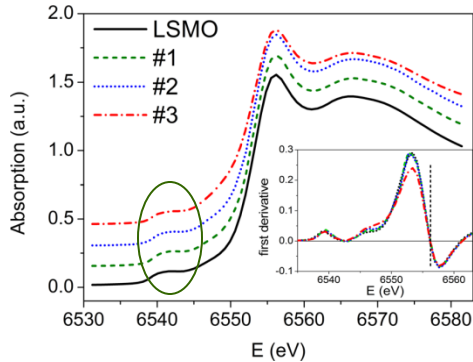
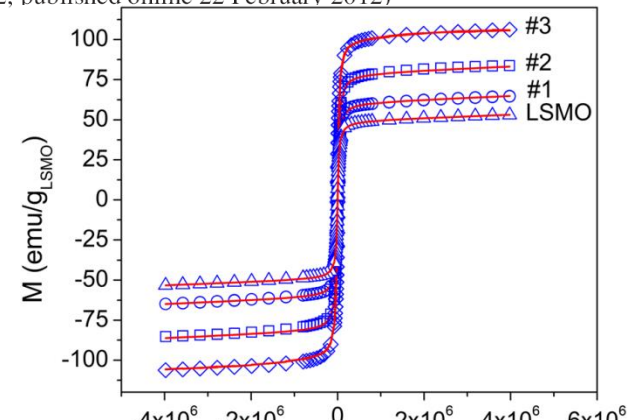
<sup>2</sup>Institute of Materials Jean Rouxel Nantes, 44322 Nantes cedex 3, France

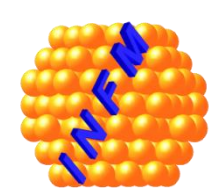
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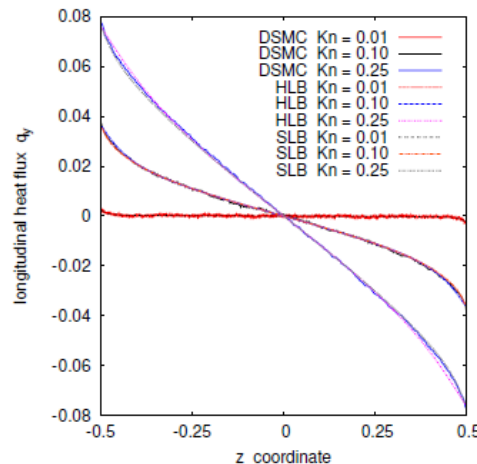
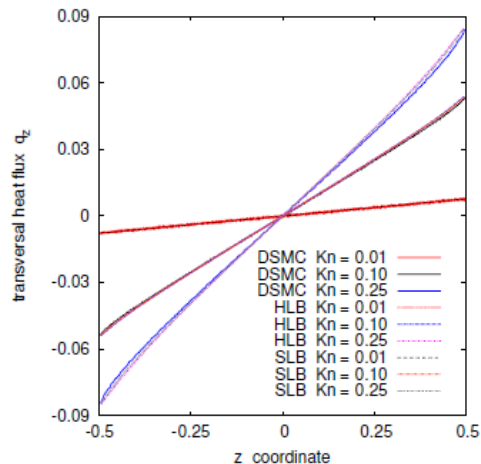
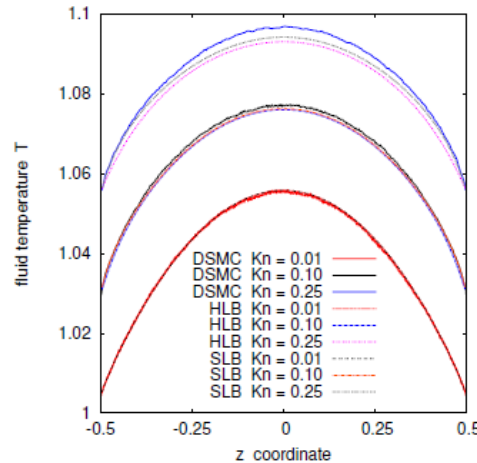
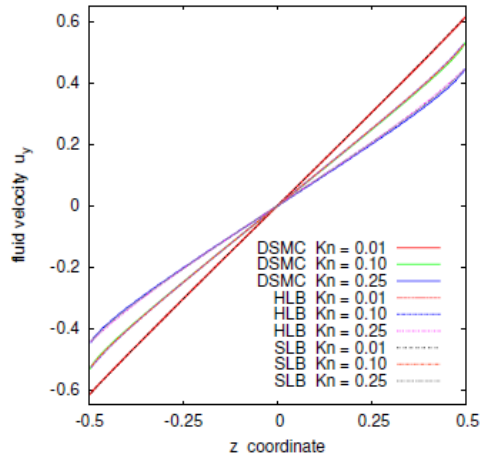


Sample	$D_m$ (nm)	$\sigma_m$	$M_S$ (emu / g of $La_{0.67}Sr_{0.33}MnO_3$ )	$\mu_S$ ( $\mu_B$ / f.u.)
LSMO	9.90*	0.175*	49.4*	2.0
LSMO@PPy #1	8.90	0.150	60.8	2.44
LSMO@PPy #2	8.05	0.185	80.5	3.24
LSMO@PPy #3	7.20	0.230	102.0	4.12





# Lattice Boltzmann simulation of microfluidics effects

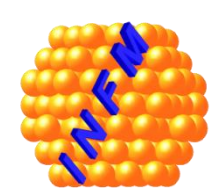


## Lattice Boltzmann models:

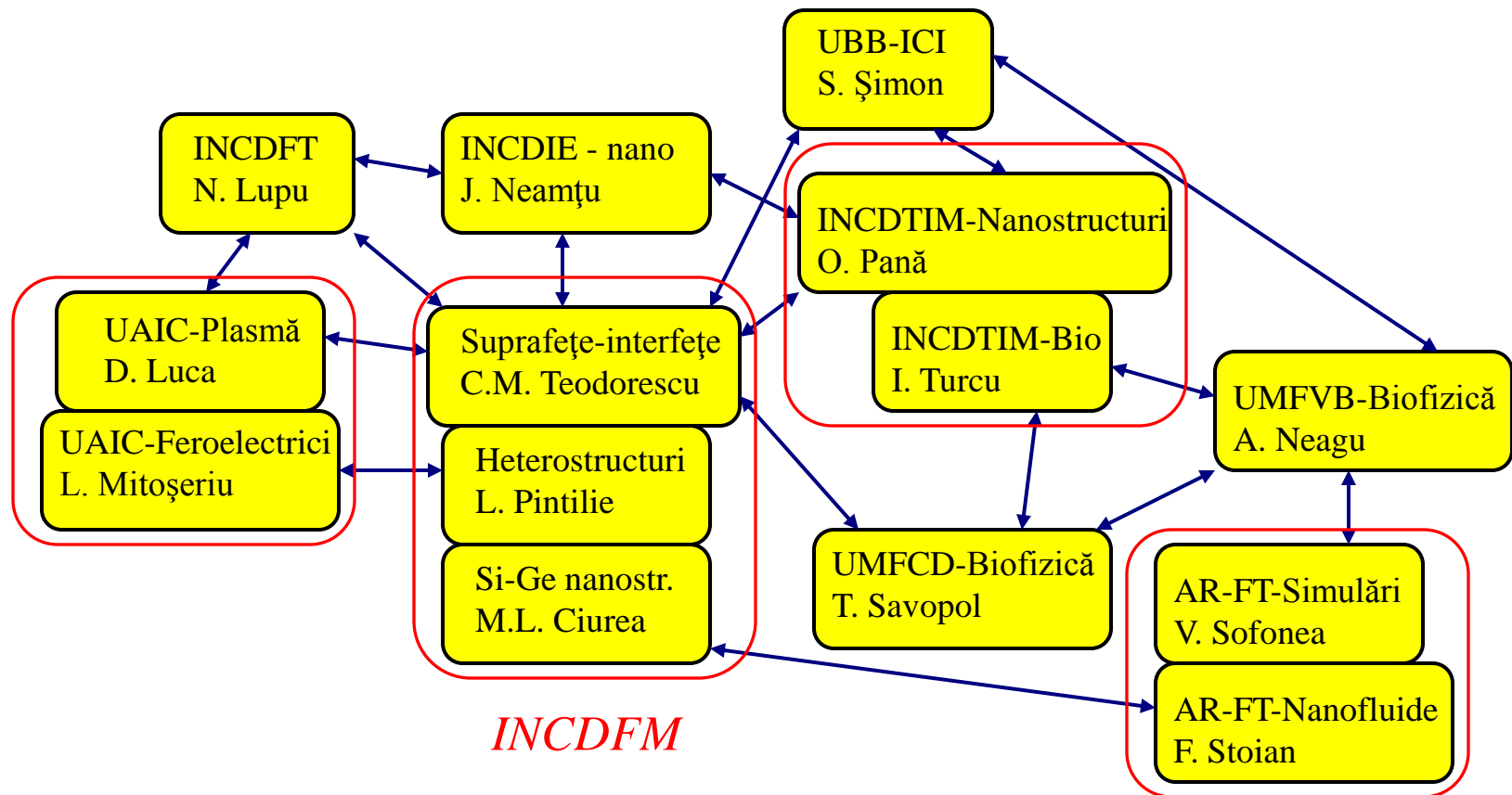
- build by separation of variables in the Cartesian (HLB) or spherical (SLB) coordinate systems:
- the momentum integrals of the distribution functions are calculated using Gauss-Hermite (HLB models) or Gauss-Laguerre/Legendre quadratures (SLB models)
- the quadrature points are related to the roots of the corresponding orthogonal polynomials of order  $N+1$

## Microfluidics effects:

- develop near the walls of the flow domain
- increase when the Knudsen number increases
- example: Couette flow
- velocity slip
- temperature jump
- transversal heat flux
- longitudinal heat flux (not driven by a temperature gradient !)
- good agreement to Direct Simulation Monte Carlo (DSMC) results
- LB models: more efficient for  $Kn < 0.5$  and better numerical stability than DSMC

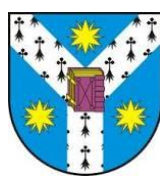
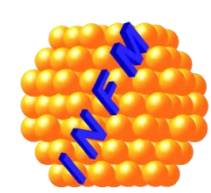


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*14 articole scrise în colaborare între echipe diferite*

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Mulțumim și La Mulți Ani,

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