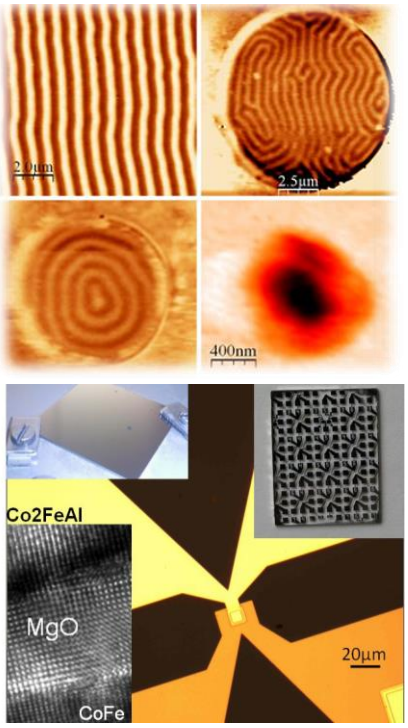
CENTER OF SUPERCONDUCTIVITY, SPINTRONICS AND SURFACE SCIENCE

Contact details

Name	**Center of Superconductivity, Spintronics and Surface Science**
Acronym	**C4S**
Logo	
Site	http://www.c4s.utcluj.ro/
Address	26-28 G. Baritiu Str., 400027, Cluj-Napoca, Romania
Faculty Department	**Faculty of material and environment engineering Physics and Chemistry Department**
Telephone	+40 264 401475, +40 733 274 834
Fax	+40 264 592055
Director	Prof. Dr. Phys. Traian Petrisor
e-mail	traian.petrisor@phys.utcluj.ro



Areas of expertise

SUPERCONDUCTIVITY: new materials and technologies for coated conductors based on YBa2Cu3O7-y (YBCO) fabrication using the Rolling-Assisted-Biaxially-Textured-Substrates approach. Applied research and development efforts include Ni-based biaxially textured tapes processing, deposition of both oxide buffer layers and YBCO films by chemical solution deposition (CSD). **Responsible/contact: traian.petrisor@phys.utcluj.ro**

SPINTRONICS: manipulation of the electron spin in electronic devices. Elaboration and study of new materials, magnetic and nonmagnetic thin film systems, the design and the patterning of individual spintronic devices for applications in the field of sensors, data storage and logic element, fundamental physics, theoretical modeling. **Responsible/contact: coriolan.tiusan@phys.utcluj.ro**

SURFACE SCIENCE. The molecular dynamics at the interface or under confinement conditions inside porous media is investigated using the noninvasive Nuclear Magnetic Resonance (NMR) technique based on diffusometry and relaxometry. The studied samples are: polymeric nano and micro-capsules used as drug carriers, ultra strong concrete, liquids confined inside porous ceramics with controlled amount of magnetic impurities, polymers, liquid crystals, binary mixtures of fluids, ionic liquids, etc. **Responsible/contact: ioan.ardelean@phys.utcluj.ro**

MATERIALS CHEMISTRY. Within this topic the following axes are developed: precursors (synthesis, characterization, single crystal growth, molecular modeling), thin films, nanoparticles and nanostructuring. Using chemical preparation methods (sol-gel) different thin oxide films with a large range of applications in electronics, optics, catalysis, wear resistance, corrosion protection and superconductivity are prepared: La0.66Sr0.33MnO3, La2Zr2O7, YBa2Cu3O7, BaZrO3. Resent research axis concerns nano-lithography using self-assembled polymer templates. **Responsible/contact: lelia.ciontea@chem.utcluj.ro**

Team

Prof. Dr. Phys. Traian Petrisor, Prof. Dr. Lelia Ciontea, Prof. Dr. Coriolan Tiusan, Prof. Dr. Ioan Ardelean, Assoc. Prof. Dr. Gavril Negrea, Assoc. Prof. Dr. Tania Ristoiu, Assist. Prof. Dr. Amalia Mesaros, Assist. Prof. Dr. Phys. Traian Petrisor Jr, Assist. Mihai Gabor, Tech. Razvan Miclea, Res. Assist. Bianca Mos, Res. Assist. Mircea Nasui.

Representative projects

ExNanoMat Supporting excellence in nanotechnology and advanced materials research, PNIII-P1-1.2- 1.2.2 PFE, (2018-2020)
EMERSPIN – "Emerging sensors and data storage spintronic devices based on magnetic tunnel junctions with enhanced efficiency magnetization manipulation" PN-III-P4-ID-PCE-2016-0143, (2017-2019), https://c4s.utcluj.ro/Current%20projects%20-PNIII-ID22-2017.html
EUROTAPES - **"European development of Superconducting Tapes: integrating novel materials and architectures into cost effective processes for power applications and magnets"**, FP6, (2012-2016)
"Unexplored magnetic vortex regimes relevant for fusion applications of superconductors." FP7 - EUROFUSION

Eneabling Project
SPINCOD- "Advanced spintronic devices for communication and data storage technologies based on Heusler compounds" PN-II-RU-TE-2014-4-1820 – SPINCOD (2015-2017)
MAGPIN-"Nano-engineered Magnetic Pinning Centers in High Temperature Superconducting Epitaxial Thin Films", PN-II-RU-TE-2014-4-2848 MAGPIN (2015-2017)
SPINTAIL-"Dispozitive spintronice mezoscopice cu proprietati magnetice si de transport controlate", PN-II-ID-PCE, IDEI (2013-2016)
SPINTRONIC- "Cercetarea si dezvoltarea de dispozitive spintronice la scara mezoscopica", POS-CCE, (2010-2013)
"Efectele dopajului si ale dimensionalitatii asupra proprietatilor magnetice, structurale si morfologice si dinamicii de spin in micro si nanostructuri oxidice feromagnetice", PNI-ID, (2010-2013)
"Nuclear magnetic resonance studies of surface effects on dynamics of molecules confined inside porous media with magnetic impurities", PNII PCE-IDEI, (2011-2016)

Significant results

The most representative publications of the past 5 years:

1. Belmeguenai, M.; Roussigne, Y.; Cherif, S. M.; et al., Influence of the capping layer material on the interfacial Dzyaloshinskii-Moriya interaction in Pt/Co/capping layer structures probed by Brillouin light scattering JOURNAL OF PHYSICS D-APPLIED PHYSICS Volume: 52 Issue: 12 Article Number: 125002 Published: MAR 20 2019
2. M Bersweiler, K Dumesnil, Y Fagot-Revurat, P Le Fèvre, C Tiusan, D Lacour and M Hehn, Spin-polarized resonant surface state in (111) Sm1−xGdxAl2, a zero-magnetization ferromagnet JOURNAL OF PHYSICS-CONDENSED MATTER Volume: 30 Issue: 43 Article Number: 435501 Published: OCT 31 2018
3. M Belmeguenai, K Aitoukaci, F Zighem, MS Gabor, T Petrisor Jr, RB Mos, C Tiusan, Investigation of the annealing temperature dependence of the spin pumping in Co20Fe60B20/Pt systems, Journal of Applied Physics 123 (11), 113905 (2018), DOI: https://doi.org/10.1063/1.5011111
4. M. Belmeguenai, M. S. Gabor, F. Zighem, D. Berling, Y. Roussigne, T. Petrisor, et al., "Static and dynamic magnetic properties of Co2FeAl-based stripe arrays", *Journal of Magnetism and Magnetic Materials*, vol. 399, pp. 199-206, Feb 2016.
5. M. S. Gabor, T. Petrisor, R. B. Mos, A. Mesaros, M. Nasui, M. Belmeguenai, et al., "Spin-orbit torques and magnetization switching in W/Co2FeAl/MgO structures", *Journal of Physics D-Applied Physics*, vol. 49, Sep 2016.
6. MS Gabor, M Belmeguenai, T Petrisor Jr, C Ulhaq-Bouillet, S Colis, C Tiusan,"Correlations between structural, electronic transport, and magnetic properties of Co 2 FeAl 0.5 Si 0.5 Heusler alloy epitaxial thin films", *Physical Review B* 92 (5), 054433, 2015;
7. R. B. Mos, M. Nasui, T. Petrisor Jr., M. S. Gabor, R. A. Varga, L. Ciontea, "Synthesis, crystal structure and thermal decomposition of Zr6O4(OH)4(CH3CH2COO)12", in *J of Analytical and Appl. Pyrolysis*, vol. 97, 2012, pp. 137-142;
8. M. Nasui, T. Petrisor. Jr, R.B. Mos, M.S. Gabor, A. Mesaros, F. Goga, L. Ciontea, T. Petrisor, "Fluorine-free propionate route for the chemical solution deposition of YBa2Cu3O7−x superconducting films", *Ceramic International* 41, 2015, pp. 4416–4421;

The offer addressed to the economic environment

Research & development	**Superconductivity and materials chemistry** The C4S is developing new materials and technologies for coated conductors using the Rolling-Assisted-Biaxially-Textured-Substrates (RABiTS) approach. Applied research and development efforts include Ni-based biaxially textured tapes processing, deposition of both oxide buffer layers and YBCO films by chemical solution deposition (CSD). **Spintronics,** dealing with the development of sensors and data storage devices based on giant - and tunnelling magneto-resistance systems. We are dealing with the design and the patterning of individual spintronic devices for applications in the field of sensors, data storage, logic elements, high frequency oscillators. Future research axes concern the superconducting spintronics which combines classical spintronics and superconductivity, the spin-orbitronics and the spintronics with graphene. **Surface Science** The NMR laboratory is designed to study molecular dynamics at the interface or under confinement conditions inside porous media; The systems under study are: polymeric nano and micro-capsules used as drug carriers, ultra strong concrete samples, liquids confined inside porous ceramics with controlled amount of magnetic impurities, polymers, liquid crystals, binary mixtures of fluids, ionic liquids, etc.
Consulting	Available for consulting within the following areas: materials science, low temperature systems, thin film elaboration and characterization tools (structural, morphological, magnetic properties), pattering using UV lithography techniques and ion beam/chemical etching, clean room facilities, high vacuum and Ultra High Vacuum deposition tools, chemical elaboration strategies for thin films and nanoparticles, molecular dynamics at the interface or under confinement conditions inside porous media via the non-invasive Nuclear Magnetic Resonance (NMR) technique.
Training	- Participating to high level teachning modules (e.g. master degree): module of nanotechnology and advanced materials. - Participating of C4S members at teaching activities within the TUCN (elementary physics and chemistry classes).