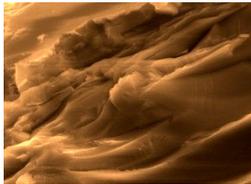
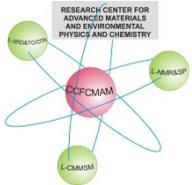
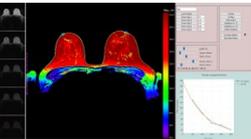
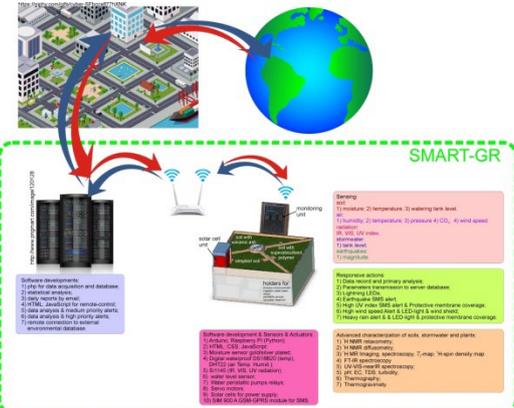


# RESEARCH CENTER FOR ADVANCED MATERIALS AND ENVIRONMENTAL PHYSICS AND CHEMISTRY

## Contact details

Name	Research Center for Advanced Materials and Environmental Physics and Chemistry		
Acronym	CCFCMAM	Vitreous $\text{TeO}_2\text{-PbO-Ag}_2\text{O-Eu}_2\text{O}_3$ SHIMADZU 6000 diffractometer	
Logo			
Site		In vivo parameter map	Bruker NMR MQ 20 Minispec
Address	103-105 Muncii Bvd., 400641 Cluj-Napoca, Romania		
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## Areas of expertise

### Laboratory of Nuclear Magnetic Resonance and Sensors' Physics (<https://nmr4.utcluj.ro/>; <https://erris.gov.ro/Laboratory-of-Nuclear-Magnet>)

- **Structural and dynamic characterization of materials** (elastomers, various polymers, bio-materials, micro-, nano-hydrogels, PEM membranes, cosmetic materials, construction materials, etc) by measurement of: 1) relaxation times ( $T_1$ ,  $T_2$ ,  $T_{1\rho}$ ) and relaxation times distributions; 2) self-diffusion coefficient; 3) dipolar correlation function (MQ); 4) 2D  $T_1$ - $T_2$ ,  $D$ - $T_1$ ,  $D$ - $T_2$  correlation maps and  $T_2$ - $T_2$  exchange maps;
- **On-line and off-line environmental monitoring**: development of monitoring platforms; detection and measurement of some pollutant's spectroscopic methods (IR, UV-Vis, EPR, NMR), sonometric, photometry, specific sensors;
- **Medical Physics**: *In vivo* MRI, MRs and fMRI measurements and *in vitro* biological tissue characterization.
- **Numeric Analysis and Numeric Modeling**: Data processing (Image, spectroscopic), Data analysis and interpretation; Statistic analysis (PCA), Artificial Neural Network (ANN) applications in physical data acquisition and analysis, Molecular Modeling; Spectroscopic modeling (FT-IR,  $^1\text{H}$  and  $^{13}\text{C}$  NMR).

### X-Ray Diffraction, TG/DTA and Spectroscopy Laboratory

- **Structural characterization of materials**: X-ray diffraction and spectroscopic methods (IR, UV-Vis, EPR) are used to realize the structural characterization of materials (glasses, ceramics, metals, etc.).
- **Characterization of physical-chemical properties of materials**: Spectroscopic (IR, UV-Vis, EPR), thermal (TG/DTA) and magnetic investigation methods are used to characterize the physical-chemical properties of materials.

### Laboratory of Computational modelling of molecular structures of materials

- Based on spectroscopic experimental data obtained for different materials, their molecular structure is achieved by using computational modelling.

## Team

Prof. Dr. Phys. Culea Eugen, Prof. Dr. Radu Fecete, Prof. Dr. Petru Pășcuța, Prof. Dr. Simona Rada, Prof. Dr. Phys. Acad. Dan E. Demco, Assoc. Prof. Dr. Pop Lidia Pop, Assoc. Prof. Dr. Liviu Bolunduț, Lecturer. Dr. Maria Boșca, Lecturer Dr. Ramona Chelcea, Lecturer Dr. Dumitrița Moldovan (Corpodean); Dr. Ing. Ramona Crainic, Dr. Ing. Lavinia Drăgan.

## Representative projects

"Structure-dynamics-properties relations and aging effects in nanocomposite elastomers and proton exchange membranes", (2011-2016):  
PN-II-ID-PCE-2011-3-0544; [http://www.phys.utcluj.ro/resurse/Cercetare/PNII\\_ID\\_307\\_2011.html](http://www.phys.utcluj.ro/resurse/Cercetare/PNII_ID_307_2011.html);

**“New nanostructured vitreous systems with possible application in the immobilization of nuclear wastes”**, (2009-2011), PNII-Idei-183/2009:  
[https://phys.utcluj.ro/resurse/Cercetare/PNII\\_ID\\_183\\_2009\\_Eng.htm](https://phys.utcluj.ro/resurse/Cercetare/PNII_ID_183_2009_Eng.htm)  
**“Obtaining and characterization of physical and structural properties of some new glasses and glass ceramics doped with 3d and 4f ions with possible applications in electronics and telecommunication”**, (2009-2011)  
 PNII-IDEI-532/ 2009, [https://phys.utcluj.ro/resurse/Cercetare/PNII\\_ID\\_532\\_2009\\_En.html](https://phys.utcluj.ro/resurse/Cercetare/PNII_ID_532_2009_En.html)  
**“New tellurate and germanate vitreous systems with applications in telecommunications”**, (2007-2010):  
 Parteneriate, [https://phys.utcluj.ro/resurse/Cercetare/CNMP\\_71099\\_2007.html](https://phys.utcluj.ro/resurse/Cercetare/CNMP_71099_2007.html)  
**MATNANTECH - “Clustering processes in oxide vitreous systems with 4f ions”**, (2006-2009)  
 CEEEX 47/2006, [http://www.phys.utcluj.ro/resurse/Cercetare/CEEEX\\_47\\_2006.html](http://www.phys.utcluj.ro/resurse/Cercetare/CEEEX_47_2006.html).  
**“Nanostructured phases in vitreous systems with 4f ions”**,  
 CEEEX POSTDOC 1546/2006, [http://www.phys.utcluj.ro/resurse/Cercetare/CEEEX\\_1546\\_2006.html](http://www.phys.utcluj.ro/resurse/Cercetare/CEEEX_1546_2006.html) (2006-2009).

## Significant results

### The most representative publications of the past 5 years:

1. R. Fechet, I.A. Morar, D. Moldovan, R.I. Chelcea, R. Crainic, S.C. Nicoara, Fourier and Laplace-like low-field NMR spectroscopy: The perspectives of multivariate and artificial neural networks analyses, *Journal of Magnetic Resonance* 324, 106915, (2021).
2. C.A. Taulescu, M. Taulescu, M. Suci, L.C. Bolund, P. Pășcuța, C. Toma, A. Urda-Cîmpean, A. Dreanca, M. Șeniță, O. Cadar, R. Ștefan, A novel therapeutic phosphate-based glass improves full-thickness wound healing in a rat model, *Biotechnology Journal* 16 (2021) art. no. 2100031.
3. P. Pășcuța, R. Ștefan, L.E. Olar, L.C. Bolund, E. Culea, Effects of Copper Metallic Nanoparticles on Structural and Optical Properties of Antimony Phosphate Glasses Co-Doped with Samarium Ions, *Materials* 13 (1), 5040, (2020)
4. Ramona Crainic, Radu Fechet, Advanced monitoring of a laboratory scale modular green roof model, *AIP Conference Proceedings* 2206 (1), 030004, (2020).
5. T. Fischer, D. E. Demco, R. Fechet, M. Möller, S. Singh, Poly (vinylamine-co-N-isopropylacrylamide) linear polymer and hydrogels with tuned thermoresponsivity, *Soft Matter* 16 (28), 6549-6562, (2020).
6. K. H. Tan, D. E. Demco, R. Fechet, A. Pich, Functional selenium modified microgels: temperature-induced phase transitions and network morphology, *Soft matter*, 15 (15), 3227-3240 (2019).
7. M. Rada, A. Popa, S. Rada, A. Bot, E.Culea, Recycled and vanadium-doped materials as negative electrode of the lead acid battery, *J. Sol.State Electrochem.*, 23(17) (2019).
8. R. E. David, R. Fechet, S. Sfrangeu, D. Moldovan, R. I. Chelcea, I. A. Morar, F. Stamatian, T. Kovacs, P. Popoi, *In Vivo* <sup>1</sup>H Nuclear Magnetic Resonance Spectroscopy and Relaxometry Maps of the Human Female Pelvis, *Analytical Letters*, 52 (1) 54-77 (2019);
9. P. Pășcuța, L. Pop, R. Ștefan, L. Olar, G. Borodi, L. C. Bolund, E. Culea, The impact of Ag and Cu nanoparticles on optical and magnetic properties of new Tb<sub>2</sub>O<sub>3</sub>-PbO-TeO<sub>2</sub> glass ceramic system, *Journal of Alloys and Compounds*, 799, 442 (2019).
10. L. Pop, L. Bolund, P. Pășcuța, E. Culea, Influence of Er<sup>3+</sup> ions addition on thermal and optical properties of phosphate-germanate system, *Journal of Thermal Analysis and Calorimetry*, 138, 1895 (2019).
11. R. Ștefan, L. C. Bolund, L. Pop, G. Borodi, E. Culea, P. Pășcuța, Copper nanoparticles enhanced luminescence of Eu<sup>3+</sup> doped lead tellurite glass ceramics, *Journal of Non-Crystalline Solids*, 505, 9 (2019).
12. S. Rada, D. Cuius, H. Vermesan, M.Rada, E. Culea, Structural and electrochemical properties of recycled active electrodes from spent lead acid battery and modified with different manganese dioxide contents, *Electrochem. Acta*, 332-339 (268) (2018).
13. S. Schweizerhof, D. E. Demco, A. Mourran, R. Fechet, M. Moeller, Diffusion of Gold Nanorods Functionalized with Thermoresponsive Polymer Brushes, *Langmuir*, 34, 8031-8041 (2018).
14. R. Fechet, I.A. Morar, D. Moldovan, R.I. Chelcea, R. Crainic, S.C. Nicoara, Fourier and Laplace-like low-field NMR spectroscopy: The perspectives of multivariate and artificial neural networks analyses, *Journal of Magnetic Resonance* 324, 106915, (2021).
15. R. Pintican, R. Fechet, B. Boca, M. Cambrea, T. Leonte, O. Camuescu, D. Gherman, I. Bene, L. D. Ciule, C. A. Ciortea, S. M. Duda, A. I. Ciurea, Predicting the Early Response to Neoadjuvant Therapy with Breast MR Morphological, Functional and Relaxometry Features—A Pilot Study, *Cancers*, 14, 5866, (2022).

### The offer addressed to the economic environment

Research & development	<b>Characterization of structural and behavioral properties of materials</b> by using spectrometric and magnetic analysis of investigation methods. <b>Design of advanced models for materials structure</b> based on spectroscopic data and computational modeling.
Consulting	<b>Consulting in:</b> <b>-spectroscopic and spectrometric analysis methods</b> (1D and 2D <sup>1</sup> H NMR relaxometry and diffusometry, X-ray diffraction, FT-IR, UV-Vis, EPR); <b>-environmental monitoring</b> (sensors/actuators, monitoring platforms, database, data processing, data analysis, sonometry and photometry); <b>-thermography and thermogravimetry;</b> <b>-magnetic measurements.</b>
Training	Training in using different spectroscopic and spectrometric analysis methods (IR, UV-Vis, EPR, NMR, Thermography), magnetic measurements, sonometry and photometry.

Last updated: January 2026