R&D services:

- Smart materials for sensing;
- Molecularly imprinted polymers;
- Host-Guest polymerization;
- Modern polymer materials for environmental safeguarding applications;
- Organic-Inorganic nanocomposites and their applications;
- Covalent immobilization of enzymes and micro-organisms onto renewable polymeric matrixes;
- High-tech, environmental hazard hydrogel solutions and targeted therapeutic nanohydrogels;
- Polyurethane foams derived from bio-based polymers/ polymeric wastes;
- End-of-lifetime options for polymers.

Lab services:

- SEC molecular weight determination;
- Spectrometric tests (FTIR, UV-Vis) and ^{1}H-NMR analysis;
- pH & conductivity determinations and potentiometric titration;
- Experimental determinations of viscosity.

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RESEARCH TEAM 1

ADVANCED POLYMER MATERIALS AND POLYMER RECYCLING

Team leader:

Eng. Tanța-Verona IORDACHE, Ph.D.

tanta-verona.iordache@icechim.ro

Excellence in Research

Expertise

The well reputed **ADVANCED POLYMER MATERIALS AND POLYMER RECYCLING** research team works collaboratively towards obtaining innovative, performant properties polymeric materials, sparing no efforts to promote chemical and physical end-of-life-cycle recycling of heavy-duty polymers and deriving applications in domains as the medical field, environmental protection, bio-technology, agriculture, thermal insulation of buildings, polymer processing/plasticizers, biotechnology, space and security.

Our most recent awards include:

1. Nanohydrogels for the controlled release of drugs and the procedure for obtaining them OSIM record A/00620/07.09.2016, Anamaria Zaharia, Anita-Laura Radu, Andrei Sârbu, Mircea Teodorescu, Bogdan Cursaru, Cătălina-Paula Spătărelu, Tanța-Verona Iordache, Sandu Teodor, Ana-Mihaela Florea: **Silver medal** at the 2019 Geneva International Inventions Exhibition and the Iranian Delegation Award.

2. Molecularly imprinted polymeric films with trinitrotoluene deposited on TiO_2 support and process for obtaining them, OSIM record A/00571/04.08.2015, Andrei Sârbu, Tanța-Verona Iordache, Ana Mihaela Florea, Steluța Apostol, Teodor Sandu, Carmen Lazău, Traian Rotariu, Gabriela Niță, Anita Laura Radu: **Gold medal** at the 2019 Geneva International Inventions Exhibition and the 2018 **Tehnoton Association Gold medal**.

For further info, scan the QR code and visit our webpage:

Infrastructure

Pulsar™ NMR spectrometer — offers high resolution performance without the need for liquid nitrogen, liquid helium or compressed gases, and a traditional deuterium lock for running 2D experiments.

Nicolet™ Summit FTIR Spectrometers - is designed with unique LightDrive Optical Engine which can achieve a spectral resolution of 0.45 cm^{-1}. The user-friendly interface of the OMNIC Paradigm Software makes life in the lab less complicated with programmed applications that streamline data acquisition, processing and interpretation.

Autolab PGSTAT204 The equipment is used in electrochemical analysis of samples, sensor testing or electro-polymerization. The results obtained are relevant and adequate for studies that can be patented or published in high impact factor journals.

The **Agilent 1200 Series G1362A Infinity Refractive Index Detector** is ideal for gel permeation chromatography (GPC) and size exclusion chromatography (SEC) providing excellent performance for entry-level UHPLC and HPLC differential refractometer (DRI) experiments.

Evolution™ 260 Bio UV-Visible Spectrophotometer Double-beam geometry ideal for kinetics or time-dynamic samples; this equipment pro-vides superior results for microcells & turbid samples. With small footprint and no warm up time required, full spectrum scans take just one second .

Projects

R&D Projects implemented to date:

1. Synthetic nanogel antibodies molecularly imprinted with the Spike S1 protein -ANTISPIKE/ PN-III-P1-1.1-TE-2021-1239 Tinere echipe 2022-2024.

2. Rational design of composite membranes for advanced heavy metal removal in wastewaters I-ON-MEM/PN-III-P1-1.1-TE-2021-0915 Tinere echipe 2022-2024.

3. Composite fuel with reduced environmental impact for autonomous propulsion systems E-CORA PN-III-P2-2.1-PTE-2021-0211 Transfer la operatorul economic 2022-2024.

4. Recycling crustaceans shell wastes for developing biode-gradable wastewater cleaning composites-BIOSHELL 157/2020: BLUEBIO/ ERA-NET Cofund.

5. Screen-Printed Hybrid Electrodes for Detecting and Monitoring Lipopolysaccharides TOXINSENS 255PED/2020: Proiect Experimental Demonstrativ PN III.

6. Ecological technology for obtaining polyester-polyols for polyurethane foams sprayed from PET waste and renewable raw materials ECOREPOL 46PTE/2020: Transfer la Operatorul Economic PNIII.

7. Detachable films for decontamination of heavy metals and radionuclides STRIP-COAT HMR 49PTE/2020: Transfer la Operatorul Economic PNIII.

8. Advanced hybrid surfaces for the biodetection of bacterial endotoxins BACTERIOSENS 123/2018: Tinere echipe 2018-2020.

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202 Splaiul Independenței Bucharest, district 6 060021, Romania

Phone: 0040-21-315.32.99
Fax: 0040-21-312.34.93
Email: office@icechim.ro

R&D services:

- Agro-industrial waste streams valorization options for a ZERO-WASTE manufacturing;
- Development of functional food and feed supplements;
- Yielding high added value products from regenerating resources:
  - biorefinery: biofuels, additives for fuels, bio-solvents;
  - anaerobic digestion: biogas (CH_4), bio-fertilizers, compost;
  - pyrolysis: bio-oil, biochar and gases
- Mitigation of greenhouse gas emission on industrial premises;
- Extraction and characterization of high add-ed value products from all types of biomass;
- Implementation of microalgae systems in industrial supply chains:
  - CO_2 mitigation;
  - waste water purification;
  - microalgae biomass valorization for obtaining value added compounds(antioxidants, PUFA, proteins etc.);
- Catalyst evaluation, screening and technical support services.

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RESEARCH TEAM 2

ALTERNATIVE BIORESOURCES AND BIOFUELS

Team leader:

Eng. Gabriel VASILIEVICI, Ph.D.

gvasilievici@icechim.ro

Excellence in Research

Expertise

The distinguished **ALTERNATIVE BIORESOURCES AND BIOFUELS** research team pursues interdisciplinary research themes pertaining to the fields of Energy, environment & climate change and Circular economy.

The team consists of 16 scientific researchers, including 10 individuals with Ph.D. qualifications, 5 Ph.D. students, and 1 master's degree graduate.

The main research areas in which our team members have achieved results are: Organic and inorganic chemistry, Chemical engineering, Food chemistry, Biology, Ecology, Environmental protection, Catalysis and catalysts.

The very nature of inter- and trans-disciplinary expertise lays the foundations for successful project implementation through collaboration and affirmation of each team member's know-how.

Research Activity at a Glance:

- **10+** novel technologies;
- **50+** academic articles published in ISI-indexed journals;
- **20+** patents & patent applications;
- **15+** Science Exhibitions Awards and Medals.

For further info, scan the QR code and visit our webpage:

Pilot Installations

Our experimental research is conducted in modern laboratories.

Over the course of time, demonstrative pilot installations have been developed to bridge laboratory and large scale production:
- experimental pilot plant for renewable resources valorization, oper-ating at SC Solvagromed SRL Mediaş, a company founded by ICECHIM in partnership with ICPAO Mediaş, as a SPIN-OFF for technological transfer.
- experimental demonstrative pilot installation biogas-microalgae, for obtaining biogas from agro-industrial waste flows by anaerobic diges-tion, coupled with wastewater treatment by microalgae systems, for a zero-waste process supporting sustainable agriculture - developed within Complex Project 32PCCDI/2018 and hosted by the National Institute of Research and Development for Potato and Sugar Beet INCDCSZ Braşov, one of the partners in this project.

Microalgae cultivation raceway open pond, 10 m^3 – Complex project 32PCCDI/2018

5 m^3 digester – Complex project 32PCCDI/2018

Projects

R&D Projects implemented to date:

1. Desulphurization through catalytic pyrolysis of crumb rubber for road bitumen modification (RUBIT) -111PTE/2022.
2. Development of health promoting food ingredients from winemaking byproducts and activated seeds (HEALTHYSEED) - 252EUK/2021.
3. Value added products from microalgae biomass apply-ing biorefinery concepts (AlgaeBioref) – 181TE/2020;
4. Complete valorisation of fish waste and oil seeds for obtaining Microencapsulated Extracts/Hydrolysates used as fertilisers or nutraceuticals – 212PD/2020
5. Innovative Fermbiotic Foods with anti-inflammatory properties (IFFA) -126Eurostars/2019;
6. Innovative health-promoting dry food matrices with enhanced functionality (PROBIBARS) - 129EUK/2019;
7. Innovative formulations of main bee products using natural ingredients (ACTIVE HONEY) - 130EUK/2019;
8. Energetic efficiency biogas plants improvement by inte-grated system: biogas-microalgae-biofuels in frame of biorefinery concept (ABCEnergie) – Complex project 32PCCDI/2018;
9. Synergistic conversion of algae: from biodiesel and its additives to syngas - 104PD/2018

National Institute for R&D in Chemistry and Petrochemistry - ICECHIM Bucharest

202 Splaiul Independenței Str., Bucharest, district 6, 060021, Romania

Phone: 0040-21-315.32.99
Fax: 0040-21-312.34.93
Email: office@icechim.ro

R&D know-how:

♦Combining different systems of targeted energy application, together with enzyme mixtures which destructures the lignocellulosic matrix, for eco-efficient extraction and biologically active compounds and biopolymers, including nano-cellulose vegetable;

♦Modulating the bioavailability of anti-diabetic, anti-hypertensive and/or compounds anti-inflammatory drugs extracted/obtained from agro-industrial by-products through the use of nanoformulations with controlled release based on biopolymers;

♦Obtaining mixtures of enzymes with action synergistic structure of lignocellulosic matrix by biosynthesis enhanced by lignocellulosic fungi;

♦Nano-bio-synthesis of compounds derived from bioresources, in microfluidic reactors, of supra-molecular structures with uses in obtaining thermo-accumulating compounds, intelligent "biomimetic" coatings, biosensors / matrices of bio-diagnosis;

♦"SMART" formulation of bioactive com-pounds generated from biomass for increasing their bioavailability.

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RESEARCH TEAM 4

BIOPRODUCTS

Team leader:

Biochem. Florin OANCEA, Ph.D. Habil.

florin.oancea@icechim.ro

Excellence in Research

Expertise

The **BIOPRODUCTS RESEARCH TEAM** pursues the superior capitalization of bio-economy's side-flows to make nutritional supplements, nutraceuticals, cosmeceuticals, additives food, biofertilizers, biopesticides and plant bio-stimulants.

Our research vision is driven by INSPIRATION THROUGH RESEARCH and is brought to life by our BRIGHT PEOPLE. With diverse academic background, passion for knowledge, appetite to challenge and be challenged, we make all the difference in adding value, project by project. Each day, we make the most of our deep understanding of LOCAL market and our GLOBAL KNOW-HOW.

We connect PEOPLE, BRANDS and MARKETS through exquisite research, and have proven research agility and expertise.

For further info, scan the QR code and visit our webpage:

Infrastructure

Protein purification chromatography system Äkta Start equipped with the Frac30 fraction collector for automatic protein collection and UNICORN software can be used for all common purification techniques.

PLANETARY BALL MILL PM 100: powerful&quick grinding down to nano range grinding with up to 33.3 x acceleration of gravity reproducible results due to energy and speed control suitable for long-term trials.

The Pure chromatography systems for any flash or prep HPLC application. Small footprint and an extra solvent platform; Cartridge/ column holders on the front of the system; Integrated UV and ELSD;

The X-ray diffractometer (Rigaku) SmartLab is a high-resolution, fast, automatically reconfigurable diffractometer for structural characterization of crystalline and amorphous materials, of (nano)composites or biological materials.

The **Chorophyll Fluorometer PAM-2500** employs measuring light of 630 nm consisting of 1 µs pulses given at frequencies from 10 Hz-200 kHz. Chip-On-Board LED array provides for strong red actinic light of 630 nm.

HPLC DIONEX ULTIMATE 3000 High Performance Liquid Chromatography with DAD detection for qualitative and quantitative analysis of compounds that absorb UV. Flexibility to accomplish all applications from method development to routine analysis with HPLC .

Projects

Emblematic R&D work:

1. Mimici de strigolactone ca ingrediente active ale unui biostimulant pentru plante multifunctional PN-III-P2-2.1-PED- 2021-2866
2. Foliar fertilizers with increased efficiency -FortiFol PN-III-P2-2.1- PTE-2021-0414
3. Sequencing techniques for valorization of side-flows in the bioeconomy and the resulting (bio) innovative products - SECVENT, MySMIS: 105684, 2016-2023
4. Optimizarea potențialului biotehnologic al Trichodermei pentru biorafinare si biostimulanți pentru plante prin dezvoltare și biosinteză controlată PN-III-P4-ID-PCE-2020-2780
5. Separation, fractionation and isolation of biologically active natural substances from corn oil and other side streams EXCornsEED, H2020 792054
6. Integrated use of the next generation plant biostimulants for an enhanced sustainability of field vegetable high residue farming systems – STIM 4+ /RO-NO-2019-540
7. Advanced Chemistry for Innovative and Emerging Technologies (ChemErgent) PN.19.23.01.01, 2019-2022
8. Biogenic nano-system for targeted delivery of bioactive ingredients on dysbiosis biofilm involved in gingivitis and periodontitis – BioNanoGum PN-III-P2-2.1-PED-2019-4527
9. A next generation plant biostimulant based on strigolactones included into stimuli responsive nanoformulation ERA.NET INCOMERA BENDIS C7/2018
10. Conversion of phytogenic silica reach food industry by -products into value-added products - Convert-Si, ERA-IB-12-159

R&D know-how:

♦ Development and validation of methods for the analysis of fertilizer, soil amendments and quality improvers;

♦ Development and validation of methods for the analysis of bio-stimulants for plants;

♦ Development and validation of methods for environmental quality assessments (water, wastes, hazardous substances);

♦ Development and validation of methods for chemical characterization and analysis of raw materials and products commissioned by com-mercial agents;

♦ Development and validation of methods for chemical analysis, commissioned by local au-thorities, for particular categories of products (biocides, explosives' precursors).

♦ Development and validation of methods to support modern analytical research in chemistry and petrochemistry.

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RESEARCH TEAM 5

ANALYSIS LABORATORY

Team leader:

Chem. Rusăndica STOICA, Ph.D.

rusandica.stoica@icechim.ro

Excellence in Research

Expertise

The Analysis Laboratory is a specialized team of eleven members (of which 6 PhD awardees, 1 PhD candidate, 2 ACS and 2 technicians), who perform both analytical research studies and accredited quality vetting services (LI843/24.03.2023/RENAR) to international standard SR EN 17025, for several business lines: Water/4 methods; Substances, chemicals & hazardous wastes/8 methods; Fertilizers and biocides /10 methods.

The Fertilizer Laboratory is acknowledged by the Ministry of Agriculture and Rural Development for fertilizing products' testing. The laboratory performs physico-chemical analysis of materials, in different matrices, and analytical characterization - by application of certified reference materials.

Research activity at a glance:

- ♦ **45**+ academic articles published in ISI-indexed journals;
- ♦ **15**+ patents & patent applications;
- ♦ **10**+ Science Exhibitions Awards and Medals.

Collaborations

Within national and international projects research team was involved as stakeholder in:

- ◊ **25+** national projects;
- ◊ **10+** international projects;

and as steward of analytical studies for:

- ◊ **100+** local & multinational companies;
- ◊ **25+** national authorities.

For further info, scan the QR code and visit our webpage:

Infrastructure

FTIR Spectrum GX Spectrometer – Perkin Elmer

Scan Range: 4000 - 400 cm^{-1} Interferometer: Dynascan Beamspliter: cuart, KBr, CsI, CaF_2, Mylar. Detector: DTGS (deuterated triglycine sulfate).

Gas Chromatography Mass Spectrometer - CLARUS 500 Analyzer: Quadrupole with prefilter. Mass range:1.0-1200 Daltons (amu). Elec-tron Ionization (standard) Positive/Negative Chemical Ionization. Electron ionization voltage: 10-100 eV. Source temperature: 120 ℃ to 350 ℃.

1100/1200 Series HPLC System Agilent Technology Detectors: WVD/ FLD and DAD / PL-ELS 1000, Evaporative Light Scat-tering. Quaternary/binary gradient pump with high pressure mixing. Micro degasser. Autosampler. Ther-mostatted column compartment.

Optima 2100 DV ICP-OES System Perkin Elmer

Measurement range: ppb/ppm - %. Double spectrometer optical system. Spectral range: 160-900 nm with resolution of 0.009 nm at 200 nm.

THERMAL ANALYSIS TGA/SDTA 851e: Measurement range: 25↔1600 °C Analytes: organic & inorganic, solid/ liquid chemical substances and polymers; **DSC 823e**: Measurement range: 65 ↔700°C Analytes: organic & inorganic, solid/ liquid chemical substances and polymers.

Thermo Scientific FlashSmart Elemental Analyzer

Measuring range:0.01% (100 ppm) – 100% for solid samples (using TCD Detector) 1–10 ppm (low level) for liquid samples (using TCD Detector).

Projects

Emblematic R&D work:

1. Sequential processes of closing the side streams from bioeconomy and innovative (bio)products resulting from it", Project SECVENT no. 81/2016, subsidiary contract no. 1799/2020.
2. "Identification, evaluation, testing, development and validation methods for the analysis of nutrients and contaminants from inputs usable in organic agriculture" - ADER 1.4.4/2019.
3. "Innovative characterization of biostimulants for plants, organic fertilizers and / or soil improvers" PN. 16.31.01.02, 2016-2017.

Emblematic Public Sector Services work:

♦ Analytical studies for biocides commissioned by the Romanian Ministry of Health, Romanian Public Works Ministry and accredited by RENAR.

♦ Analytical studies for explosives precursors, commissioned by the Romanian Ministry of Economy and accredited by RENAR.

Emblematic Private Sector Services work:

♦ Control of products' conformity: fertilizers, biocides and water;

♦ Complex analytical studies for:

◊ analysis of the storage stability of the wheatgrass (Triticum Aestivum L.) juice in terms of antioxidant activity and their polyphenols content;

◊ polymers characterization (FTIR, HPSEC, TA);

◊ molecular weight averages and molecular weight distribution of alkyd resins by High Performance Size-Exclusion Chromatography (HPSEC);

◊ physico-chemical and thermal analysis (TA) of acrylic vinyl copolymers in aqueous dispersion;

◊ physico-chemical studies for determination of some flocculants in industrial waste waters effluent outfalls to surface waters;

◊ determination of various solvents from urea-formaldehyde formaline solutions.

R&D services

- Food safety risk assessments;
- Microbiological analysis: antimicrobial activity of different compounds or materials/ evaluation of antibiotic susceptibility to microbial strains;
- Microbial degradation of substances (inorganic and organic pollutants) and materials (plastics, composites);
- Biological control of plant diseases;
- Sensors and biosensors development for real-time monitoring and control of environment and food quality;
- Flow analysis bioassay modelling;
- Prototyping of new biotech products from industrial and agricultural by-products;
- Bio-composites preparation and bio-characterization methodology development.

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RESEARCH TEAM 6

BIOTECHNOLOGY & BIOANALYSIS

Team leader:

Chem. Ana-Maria GURBAN, Ph.D.

ana-maria.gurban@icechim.ro

Excellence in Research

Expertise

The **Biotechnology & Bio-analysis Team** has been and is intensely called-upon to carry out experiments and test the antimicrobial activity of some compounds, materials etc., both by ICECHIM affiliated researchers as well as by other well reputed R&D institutions.

Some of our results have been communicated to the scientific world through publications and presentations in international events. Moreover, based on this expertise, our team was coopted as a partner in Experimental Demonstrative Projects/PED and Technological Transfer to industry projects/PTE competitions organized by UEFISCDI.

Our biotechnological approach of the research topics is based on the Collection of Microorganisms (*Aspergillus, Trichoderma, Cladosporium, Penicillium, Mucor, Paecilomyces, Candida, Bacillus, Pseudomonas* etc.). Collection enrichment through isolation from various sources as well as acquisition from established microbial collections, and, not the least - its maintenance, are permanent concerns of team microbiologists.

An important achievement is the continuous modernization of R&D infrastructure with the financial support of National Authority for Scientific Research, through the CAPACITIES project CP 49/2007 "Biotechnology & Bioanalysis Laboratory". The four modernized Laboratory divisions are: Microbiology Lab, Separation Lab, Optical Methods Lab and Biosensors Lab. The Microbiology Lab adheres to Good Laboratory Practice guidelines and is designed with separate rooms to ensure personnel safety, as well as to maintain sterile working conditions in order to minimize the potential for sample contamination.

For further info, scan the QR code and visit our webpage:

Infrastructure

OLYMPUS BX 51 Optical Microscope allows reflected light observation as well as transmitted light observation . . It is equipped with the U-DICT prism with U-ANT analyzer. Provides accurate color reproduction of the observed sample.

Faster SafeFAST Classic vertical laminar flow cabinets are Class II Microbiological Safety Cabinets – designed and built to performance requirements of the EN-12469:2000 European Standard and NSF/ANSI 49 American Standard.

KLF 2000 BIOREACTOR is an in situ serializable bench-top bioreactor made of glass, being impressive due to its ease of operation and the many combinations and possibilities of extension. Controlled with BioSCADA IT provides best in class oxygen transfer rates.

ECO Chemie/ Metrohm µAutolab III Galvanostat/ Potentiostat Electrochemical Tester The µAUTOLAB Type III in combination with GPES 4.9 software can be used for all standard DC-electrochemical techniques.

FINNIGAN Surveyor Plus HPLC, Thermo Scientific, USA This device is specifically optimized for the most demanding HPLC applications and allowing full customization for our laboratory's applications.

Projects

R&D Projects implemented to date

1. Detection of biogenic amines in food, based on an innovative opto-electrosensitive platform PN-III-P2-2.1-PED 2021-1942 (2022-2024).
2. Innovative nanomaterials based on fullerenol-hydrogels for health diagnostics and care applications FULSENS-GEL COFUND – M – ERA – NET 3 - FULSENS-GEL /CTR.318/2022 (2022-2024).
3. Manufacturing of a portable system for nitrite monitoring in soil based on an innovative sensor, NITRISENS 216/2020 (2020-2022).
4. Biotechnological strategies for innovative construction materials incorporating bacterial bioproduct (BioConstrMater),PN-III-P2-2.1-PED-2019-0991/PED 392/2020 (2020-2022).
5. Senzori si biosenzori inovativi pentru determinarea unor compusi toxici de tipul aminelor biogene si disruptorilor endocrini din alimente si mediu, PN 19.23/2019-2022 (2019-2022).
6. Manufacturing of new online analytical systems for toxin hazard assessment in dairy industry Proiect MANUNET (TOX-HAZ-ASSESS) (2017-2019).
7. Peroxynitrite: Relevance for Food Safety and Novel Elec-trochemical Detection, PN-II-ID-PCE-2011-3-1076/ 184/2011 (2011-2016).
8. Biotechnological valorization of animal waste substrates through through degradative potential of keratinolytic fungi, Project PN 16.31.01.03 (2016-2017).

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202 Splaiul Independenţei Str., Bucharest, district 6, 060021, Romania

Phone: 0040-21-316.30.63
Fax: 0040-21-316.30.63
Email: biotehnologie@icechim.ro

R&D know-how:

- Innovative nanomaterials: synthesis and characterization;
- Nanomaterials with antimicrobial properties;
- New (nano) materials for environmental applications;
- Development of materials with enhanced properties for specific applications;
- Phyto-synthesis of metallic nano-particles;
- New prescriptions for restoration/ conservation of cultural heritage artifacts;
- Archaeometry and Restoration/ Conservation studies;
- (Natural) Surfactants: synthesis, characterization and applications;
- "Green chemistry" applications;
- Colloidal systems in applications related to the increase of the quality of life;
- Analytical evaluation methods for detergents, cleaning products, soaps and cosmetic products.

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RESEARCH TEAM 7

EMERGING NANOTECHNOLOGIES

Team leader:

Chem. Irina FIERĂSCU, Ph.D. Habil.

irina.fierascu@icechim.ro

Excellence in Research

Expertise

The **EMERGING NANOTECHNOLOGIES TEAM** stands as one of the most prolific research teams affiliated with INCDCP-ICECHIM in terms of academic output and research grants awarded through competition.

The team includes two senior, PhD theses coordinating researchers (1st degree), two 3rd degree researchers and three young researchers. The sector of expertise of this research group is Materials Science, in the context of which the thematic area of preference is Nanotechnologies covering topics within the category of emerging applications: Environmental protection, Construction materials, Cultural heritage Preservation, Nanoparticles' phyto-synthesis & structural characterisation. Most often than not the afferent R&D topics refer to archaeometry and synthesis, characterization and applications of (natural) surfactants with a particular focus on boosting the innovation potential of R&D respective beneficiaries.

Research activity at a glance:

- **40**+ novel technologies;
- **130**+ academic articles published in ISI-indexed journals;
- **25**+ patents & patent applications;
- **150**+ Science Exhibitions Awards and Medals.

For further info, scan the QR code and visit our webpage:

Infrastructure

ICP-AES Spectrometer Liberty 110 (Varian): 40.68 MHz RF Generator and a 0.75 m Czerny-Turner Monochromator with a 1800 grooves/mm Holographic grating.

Ultra 3660 (RIGOL) UV-VIS spectrometer: Ultra-low stray light ≤0.03%T, 0.5nm optical resolution with 4 options for spectral bandwidth selection, Versatile test solutions, with built-in bio-analytical methods.

SIGMA 700 _ KSV Tensiometer: The tensiometer system is a high performance surface tension/contact angle meter. It expands from a basic all round Tensiometer into a highly sophisticated precision measuring system for R&D.

The Brookfield DV-II+Pro Viscometer measures fluid viscosity at given shear rates. Viscosity is a measure of a fluid's resistance to flow applications. The DV-II+Pro offers exceptional versatility in modes of control allowing for traditional standalone operation, automatic operation or with complete control by PC.

Non-destructive equipment for cultural heritage items and materials evaluation: Extech MO257 Pinless Moisture Meter (relative pinless moisture reading), B-150DBR Optika and OPTIKA SLX-3 Microscope, RGB-2000 Colour analyser, Extech CG204 portable tester for paint thickness, automatically detectable.PCE-GM80-ICA certified gloss device, PCE-XXM20 colorimeter, Infrared thermometer, thermal imaging camera, endoscopic camera, and others.

Non-destructive equipment for environmental applications: Extech MO750 soil humidometer, digital soil thermometer, soil pH tester, GAMMA SCOUT Geiger detector, soil conductivity tester, 11 in 1 ambient measuring instrument, portable microscope and others.

PW 4025 MiniPal 2 (PANalytical) Energy Dispersive XRF desktop spectrometer—for non-destructive analysis of elements from sodium right through to uranium, in concentrations from 100% down to ppm levels.

Vanta C Series Handheld XRF (Olympus): Rhodium (Rh) anode 40 kV X-ray tube, SDD (Silicon Drift Detector), In-line camera for aiming, 3mm X-ray spot collimation and 5 megapixel sample camera for documenting tests. GeoChem and Precious Metals Calibrations.

Projects

Emblematic work:

1. Screening and designing biostimulants using electrochemical sensors and fluorescent bioassay: filling the gap between industry and science BioScreen 116PD/2022.
2. Through nanotechnology towards the next generation dental restorative materials NANODENT 92PCE/2022.
3. High performance phytosynthesized nanostructures as biosensor platforms for detecting pathogenic microorganism from food matrices NanoBIOPAT 652PED/2022.
4. Integrated technology for advanced removal of heavy metals and arsenic from complex matrices using adsorbent nanomaterials OxyAds 81PTE/2022.
5. Antimicrobial nanocomposites based on polyurethane foam for biomedical applications, synthesized by radiation assisted technology PuMA 612PED/2022.
6. Formulations of protective cosmetic products obtained by applying integrated and sustainable bioeconomy approaches BioProtect 644PED/2022.
7. Innovative multifunctional composites for the protection of cultural heritage objects InHeritage 591PED/2022.
8. Transdisciplinary approach for development of technological solutions for target compounds recovery from agro side-stream E!13365/TARDIS, 220/2020;
9. Evaluation of the exploitation potential of porous materials in the treatment of microbiota-related diseases 524PED/2020;

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Phone: 0040-21-315.32.99
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Email: office@icechim.ro

R&D know-how:

♦ Applied and fundamental research for obtaining **new multi-phase polymeric materials** compatible with **3D/4D** printing for sustainable applications in agreement with the new economy of plastics regarding the transition from fossil carbon to renewable those. Pre- and post-consumer polymeric items mechanical recycling considering the defects dilution principle.

♦ Development of new active/smart multi-phase polymeric materials and biomaterials compatible with **3D/4D** printing with increased resolutions, products of commercial interest, larger in size, complex shape and surface.

♦**3D/4D** printing considering methods as fused filament fabrication, sintering (in perspective), photopolymerization (in perspective), others.

♦ Pre-and post-consumer polymeric items mechanical recycling obtained through **3D/4D** printing techniques considering the defects dilution principle.

♦ Technologies for various level of technological maturity.

We're keen on engaging in national and international collaborations to advance:

◊ **3D** and **4D** printing design (Scanning, conversions in a **3D** CAD representation and printing);

◊ Scaling–up materials and **3D/4D** printed parts-products;

◊ New printing techniques;

◊ Connex topics related to customized innovative materials.

Contact us

to design your next-generation

shape memory materials

for 3D/4D printing!

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RESEARCH TEAM 8

MULTIPHASE MATERIALS

Team leader:

Biochem. Florin OANCEA, Ph.D. Habil.

floring.oancea@icechim.ro

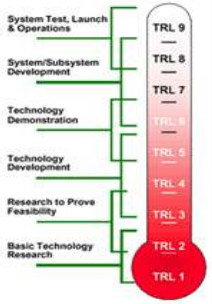
Excellence in Research

Expertise

The **MULTIPHASE MATERIALS RESEARCH TEAM**'s expertise pertains to the science and technology of polymers and biopolymers with particular focus on the structuring of multi-phase materials through melt compounding techniques.

Our fundamental and applied research endeavors revolve on the structuring of polymeric materials based on non-renewable and renewable polymers considering thermodynamic and macromolecular engineering principles to reach properties of interest, mainly for engineering requirements in sustainable **3D/4D** applications.

Controlling the interface phenomena by changing the interface morphology and/or macromolecular mobility and/or melt rheological behavior to increase the physical/chemical/biological/ rheological compatibility complete the priority que of our team's R&D interests.



Research activity at a glance:

- **30** Scaled –up technologies (TRL 5 and TRL 7);
- **80** academic articles published in ISI-indexed journals;
- **27** patents & patent applications;
- **5** book chapters;
- **170** papers presented in national/international Science events.

For further info, scan the QR code and visit our webpage:

Infrastructure

OBTAINING, CHARACTERIZATION AND SHAPING NEW POLYMERIC MATERIALS Extruder Buss PR 46, Buss A.G. Basel Switzerland / The screw has a synchronously rotation move with two others, with axial advance and withdrawal after. Appliances for shaping of new polymeric materials.

RHEOLOGICAL CHARACTERIZATION OF POLYMERIC MELTS in elongational field (MELT Indexer for shear rate, shear stress, fluidity, melt flow resistance, activation energy of viscous flow (Ea), melt density etc.) and in shear and elongational field at various pressures (Gottfert rheometer (0 - 100, -200, -500, -1000 bar / screws: transport, rheology, compression; 30mm / Rheology: 375 alimentation zone; 275 rheology zone).

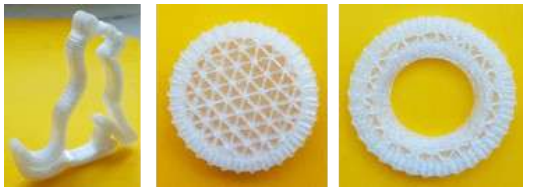
LABORATORY FACILITIES TO ACHIEVE & CALIBRATE 3D/4D PRINTING FILAMENTS Gottfert rheometer (nozzles of 1.85 mm and 3 mm) and laboratory line for calibration –cooling (with air or water) - drawing - rolling filaments for 3D/4D printing zone).

3D/4D PRINTERS

Projects

Emblematic R&D work (2016-2020):

1. SECVENT Subsidiary project 2608/22.12.2020;
2. SECVENT Subsidiary project 1480 / 29.07.2019;
3. PN.19.23.02.01/2019;
4. 3D-LONG-LIFE (Project 40 / 2018 –5);
5. 3D-ECO-TOUGH (CEC212 /2018);
6. PN.16.31.03.02/2017;
7. 3D-ECO-GLASS (CEC 52 /2017);
8. BIO-MULTY-PACK (2016).



R&D know-how:

- Hybrid magnetic nanoparticles;
- Hydrogels;
- Silver micro-/nano-particles and silver-polymer hybrids;
- Metallic oxides micro-/nano-particles;
- Ultra-reinforced nano-composites with layered silicates;
- Porous clay heterostructures;
- Mesoporous materials;
- Core-shell micro- & nano-particles.

Applications:

- Controlled release devices for bioactive substances;
- Biomimicry for smart coatings;
- Development of self-healing materials;
- Development of self-cleaning materials;
- Development of phase-changing materials for thermal energy storage;
- Development of intelligent packaging solutions.

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to design the optimal system architecture

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RESEARCH TEAM 9

HETEROGENOUS SYSTEMS

Team leader:

Eng. Cristian PETCU, Ph.D.

cristian.petcu@icechim.ro

Excellence in Research

Expertise

The **HETEROGENEOUS SYSTEMS TEAM** conducts fundamental, applied and experimental research at the forefront of modern research by engaging seasoned and sophomore scholars to advance science development through national and international collaboration with some of the most prestigious universities and institutes from France, the Czech Republic, Greece, Spain and Italy.

Its prized expertise in the field of synthetization and characterization of micro- & nano-structured materials allows for renderings of complementary applications in domains that include biotechnology, automotive, renewable energy, diet, health, agriculture, textiles, electronics and environmental sustainability.

Ever since 2000, the team has been consistent about delivering significant contributions to the advancement of Nanoscience and Nanotechnology fields by managing no less than 44 national and international R&D projects among which it lead the **En**hancement the Quality Participation at FP6 Projects in the **Po**lymer **Na**nomaterials Field (ENPONA) and co-hosted 2 major initiatives (**H**igh **A**spect **R**atio **Ca**rbon-based **Na**nocomposites - HARCANA PC7-Large, A fundamental study of the **pro**cessing-structure-properties of **na**no-**com**posites for industrial applications - PRONACOM FP5 IP) at European level.

Research activity at a glance:

- engaged in **50+** national and **10+** international R&D grants;
- **250+** academic articles in ISI-indexed journals;
- **14** patents & patent applications;
- **380+** conference papers.

For further info, scan the QR code and visit our webpage:

Infrastructure

The **FEI Quanta 200 Environmental Scanning Electron Microscope (ESEM)** is a high-tech analytical device that can be operated both in cold and heat stages to process images at numerical aperture magnification of above 100000x, preferences and other conditions being kept available for adjustments and storage in dynamic dialogue logs. This important and widely used analytical tool provides exceptional depth of field, minimal specimen preparation and the ability to combine the technique with X-ray microanalysis.

The **Zetasizer Nano system** performs Laser Doppler Electrophoresis generating relevant results for applications in the latexes, waste water treatment and emulsion production. Particle size measurements and zeta potential are scaled using a combination of processes (Dynamic Light Scattering) and techniques (Debye modelling and Laser Doppler Velocimetry).

Complete Thermal & Thermomechanical Analysis System composed of: TA Q5000 IR (TGA), TA Q2000 (DSC), TA SDT Q600 Simultaneous DSC and TG Analysis coupled with Mass Spectrometer (SDT-MS), TA Q800 Dynamical Mechanical Analysis (DMA).

The **FT-IR Bruker Tensor 37** coupled with **Golden Gate diamond ATR unit** is an advanced, flexible benchtop Furrier Transformation Infra Red Spectrometer enhances and advances routine, as well as exceptional analytical laboratory work.

Projects

Latest R&D pursuits:

1. New intelligent anti-corrosion coatings for active protection of metallic surfaces, enhanced with stimuli-responsive mesoporous silica nanocontainers loaded with organic inhibitors PN III TE/2020-2022;
2. Advanced nanoparticle-based materials with synergistic effect on neuronal oxidative stress and beta-amyloid fibrillation for preventive treatment in Alzheimer's disease PN III PED/2020-2022;
3. Innovative 3D printed nanocomposite constructions obtained from marine resources (alginate, salecan) and natural clay with specific applications in bone regeneration PN III PED/2020-2022;
4. Advanced material based on push-pull extended π-conjugated azo-chromophores in functional matrices with enhanced NLO properties PN III PED/2020-2022;
5. Nanostructured hybrid materials obtained by «eco-friendly» methods for the surfaces protection against damages caused by micro-organisms and pollutants PNIII PCCDI/2018-2020;
6. Optimization and validation of an advanced material and technology default based on biopolymer-modified clay as carriers for controlled release of doxorubicin in gastrointestinal tract PN-III-P2-2.1-PED-2016-1896/2017-2018

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202 Splaiul Independenţei Str., Bucharest, district 6, 060021, Romania

Phone: 0040-21-315.32.99
Fax: 0040-21-312.34.93
Email: office@icechim.ro

R&D know-how:

♦ Synthesis of innovative materials based on functional dyes and pigments (stimulated color changing materials, lu-minescent systems for energy transfer, adaptive systems for light manipulation);

♦Hybrid organic-inorganic coloring mate-rials and film-forming materials for rigid and flexible substrates (photocatalytic coatings, anticorrosive film-forming mate-rials, antireflective properties, resistant to over coating);

♦Conditioning of coloring materials as free flowing and easy dispersible powders, dispersion in liquid vehicles or by encap-sulation in different matrices;

♦Chemical structure investigation, evalua-tion of optical properties by molecular spectroscopy, color measurements and evaluation of color differences;

♦Functionalization of textile materials (pretreatment, dyeing and finishing solu-tions, modifying of textile fabrics, provid-ing functional effects — sensors, conduc-tive, camouflage, self-cleaning).

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to add some color to your

life!

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FUNCTIONAL DYES LIFE in COLOR

RESEARCH TEAM 10

FUNCTIONAL DYES & RELATED MATERIALS

Team leader:

Eng. Valentin RĂDIȚOIU, Ph.D.

vraditoiu@icechim.ro

Excellence in Research

Expertise

The **FUNCTIONAL DYES AND RELATED MATERIALS RESEARCH TEAM** accounts for one RESSCI I senior scientist, one RESSCI II senior scientist and one RESSCI III researcher.

Our experts, specialized in synthesis and characterization of chromogenic materials, have a solid background in applied color science, with a significant expertise in dyes and pigments associated technologies.

Besides chromogenic materials based on classical dyes and pigments and their applications, our current focus is bestowed to functional dyes, including hybrid structures for stimulated color changing materials, luminophores, and colorants for manipulation of light and energy transfer with suitable properties for emerging technologies (metamaterials, multifunctional structures, holography, organic conductors, light concentrators or E - textiles).

Research activity at a glance:

- novel technologies/methods;
- **150+** academic articles published in ISI-indexed journals;
- **15+** patents & patent applications;
- Multiple Science Exhibitions Awards and Medals.

For further info, scan the QR code and visit our webpage:

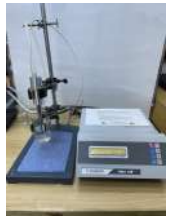
Infrastructure

JASCO V570 UV-VIS-NIR spectrophotometer Beyond just measuring UV-VIS-NIR spectra with microscale sampling areas this is a highly flexible instrument capable of micro-spotting thin film thickness and colorimetry measurements.

JASCO FP6500 spectrofluorimeter (220-750 nm, resolution 1nm), integrating sphere ISF-513 for solid state quantum efficiency, fluorescence color measurements.

JASCO FTIR 6300 spectrophotometer equipped with several accessories for ATR measurements; FTIR specular reflectance; thickness of films; Diffuse Reflectance (DRIFT); 80° reflection for thin films; Mid-IR integrating sphere.

Ultrasonic processor VCX-750—Sonics uses ultrasonic power to apply high shear and intense stress to liquids, powder/liquid mixtures and slurries for mixing, dispersing, particle size reduction, extraction and chemical reactions.



Ultrasonic atomizer VCX-134—Sonics uses ultrasonic vibrational energy to generate a low-velocity spray. The liquid can be dispensed to the atomizing probe and atomized continuously or intermittently.

The Xenotest 150 S+ combines the latest in weathering testing technology, economical testing, optimum reproducibility and good correlation to natural weathering, to deliver an instru-ment that has helped set the standard in textiles material durability testing.

Projects

Emblematic R&D work:

1. New biocompatible products shagaol and curcumi-noid-like type used as adjuvantes in cancer radio-therapy—CANRADIOPROTECT, 2020-2022.
2. Innovative hybrid materials with photocatalytic properties/Innovative polymer-based nanotechnolo-gies for new advanced materials—NAPOLI 19, 2018-2020.
3. Passive multispectral camouflage systems based on organic-inorganic chromogen-polymeric hybrid structures — MULTICAM/Contingency of CBRN hazards and improvement of national security re-sources, 2018-2020.
4. Anticorrosive colored epoxy coating systems —ACOREPOXICOLOR, 2016-2018.
5. New generation of photocatalytic self-cleaning sys-tems for functionalization of technical textiles and architectural coatings—CLEANPHOTOCOAT, 2014-2017.
6. Thermosensitive energy saving systems with tai-lored solar reflecting/absorbing properties for con-struction structures—THERMOSOLAR, 2012-2016.

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202 Splaiul Independenței Str., Bucharest, district 6, 060021, Romania

Phone: 0040-21-315.32.99
Fax: 0040-21-312.34.93
Email: office@icechim.ro

R&D know-how:

♦Advanced methods for monitoring, investigation, diagnosis, intervention on various types of cultural heritage artefacts;

♦Advanced investigation techniques to evaluate the degradation stage of works of art; treatments, scraping, structural repairs and reintegration, consolidation, wet and dry cleaning;

♦Characterization of degree of deterioration/ degradation, by analytical techniques such as: GC-MS, ion chromatography, XRD, FTIR, SEM, gloss tests, layer thickness, porosimetry, moisture and salt content analyses, freeze-thaw tests;

♦Development of new materials (nanomaterials: hydroxyapatite and derivatives, clays, metal oxides, metal nanomaterials - noble metals) for conservation and restoration (chemical and microbiological) of cultural patrimony artefacts;

♦Nanoparticles and nano-formulations for different drugs (liposomes, micelles and microcapsules) as sensitizers in medical photochemotherapy;

♦Preparation of metallic nanomaterials (silver, gold, platinum) in plant extracts;

♦Synthesis, characterization and applications of polymeric gels;

♦Gel and polymeric systems for conservation/ restoration practice;

♦Anti-slipping and antimicrobial mats in museums entrance;

♦Waste recovery polymeric composites with enhanced properties.

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for an integrated approach to

Cultural Heritage Preservation!

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RESEARCH TEAM 11

EVALUATION & CONSERVATION OF CULTURAL HERITAGE

Team leader:

Univ. Prof. Rodica-Mariana ION, Ph.D.

rodica.ion@icechim.ro

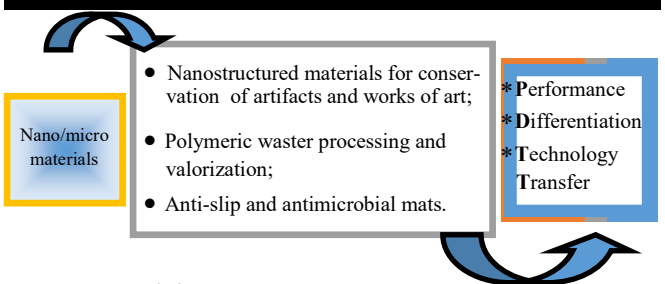
Excellence in Research

Expertise

The **EVALUATION AND CONSERVATION OF CULTURAL HERITAGE RESEARCH TEAM** accounts for experts in cultural heritage diagnosis and conservative treatments applied to ancient monuments, works of art and artefacts of Romania.

Our core expertise, as set forth on various occasions through high impact national and international publications and patents, concerns Materials Science, Nanomaterials for Cultural Heritage preservation, and Materials for Buildings (newly synthetized or recovered).

Services and Products



Research activity at a glance:

- **Hirsch Index 34** (Google Scholar);
- **25** (Scopus and ISI web of knowledge);
- **425** academic articles published in ISI-indexed journals;
- **90** Science Exhibitions Awards and Medals;
- **9** books and **23** book chapters;
- **72** national patents;
- **1** European patent.

For further info, scan the QR code and visit our webpage:

Cultural Rescue Work

Roman Mosaic, Constanța

Basarabi Churches Ensemble, Basarabi Murfatlar, Constanța

Adamclisi Monument (bas-reliefs), Constanța

Corvin Castle (Fresca Loggia Mathia) & Archeollogy Museum, Hunedoara

Fântâneanu House, Slatina

Nanu Muscel House, Bucharest

Photo credits: personal archive of Univ. Prof. Dr. Chim. Rodica - Mariana ION

Projects

Emblematic R&D work:

1. 3D technologies and experimental solutions for diagnosis and preservation of cultural heritage PN-III-P2-2.1-PED-2021-3885, 2022-2024;
2. EU-funded COST Action COMULIS 2018 - 2022 (Correlated Multimodal Imaging in Life Sciences) www.comulis.eu ;
3. COST CA17121 - Correlated Multimodal Imaging in Life Sciences, 2018-2022; cost.eu/actions/CA17121/;
4. Innovative method based on nanomaterials for the conservation / restoration of cellulose artefacts (paper and wood) from archives and museums (Bilateral Co-operation with South African Republic), 2016-2018;
5. ARHEOCONS 2018-2020: New diagnosis and treatment technologies for the conservation and revitalization of archaeological com-ponents of the National Cultural Heritage, PN-III-P1-1.2-PCCDI-2017-0476;
6. Innovative protection solution for acrylic paintings surfaces PN-III-P2-2.1-CI-2017-0599, 2017;
7. An integrated approach for reinforcement of histori-cal chalk monuments by means of nano-materials-based treatment - A revolutionary concept, PNII- 222/2012-2016;
8. Innovative techniques and materials for preserva-tion / restoration of stucco and decorative elements of masonry in patrimony buildings, PNII 261/2014;
9. Technology for efficient environmental recovery of plastic materials from computer and telecommunication equipment as high-performance composites (COMPLAST),Contract de finanțare: 84 PCCDI / 2018, www.icechim.ro/complast/

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R&D know-how:

♦Experience gained and technologies developed in the frame of one FP 5, two FP 7 and one H2020 project initiatives (PRONACOM, NANOTOUGH, EVOLUTION and IZADI-NANO2INDUSTRY), further implemented and validated to TRL 5-TRL 7 for production of masterbatches:

◊ based on montmorillonite nanolayers/ halloysite nanotubes for improving the toughness of composites based on polypropylene (PP) with 20-40 % of glass fibres;

◊ based on nanosilica for improving the scratch resistance of composites based on PMMA;

♦High quality automotive components (bumper, spare wheel well, B-pillar);

♦Biopolymer composites for food packaging and biomedical applications;

♦Collagen-layered silicates based technolo-gies and products for veterinary use;

♦Hybrid nanocomposites (inorganic-organic) based on double layered hydroxides (LDH) for protective coatings;

♦Synthesis of polymeric materials starting from petrochemical monomers as well as from monomers derived from renewable resources;

♦ Synthesis of some catalytic systems for ani-onic-coordinative polymerization.

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RESEARCH TEAM 12

POLYMER COMPOSITES & NANOCOMPOSITES

Team leader:

Eng. Adriana-Nicoleta FRONE, Ph.D.

adriana.frone@icechim.ro

Excellence in Research

Research areas

The **POLIMER COMPOSITES AND NANOCOMPOSITES TEAM** is the paramount example that addressing the importance of chemistry is the key to successful team building. Together they spare no effort in advancing science in the fields of:

♦Composites and nanocomposites based on natural or/ and synthetic polymers with different natural or/and synthetic fillers and nanofillers with improved properties required for various applications in packaging, automotive, electrotechnical, agricultural and biomedicine:

- Polymer nanocomposites based on natural nanoclay, nanosilica, layered double hydroxide (LDH) for automotive applications

- Composites based on biopolymers with graphene or /and LDH for automotive applications

- Biocomposites based on nanocellulose and biopolymers (polylactic acid, polyhydroxybutyrate, polyvinylalcohol, starch) for packaging and biomedical applications

- Composites based on polydimethylsiloxanes and different inorganic and organic fillers

- Synthesis of new environmentally friendly materials, especially in the field of isolation of cellulose micro- and nanofibers from various renewable resources;

- Surface modification of micro and nanofillers for compatibilisation with polymer matrix.

♦Characterization of polymer composites and nanocomposites

- Surface characterization of nanomaterials by atomic force microscopy, nanoindentation and contact angle

- Mechanical, nanomechanical, thermal, dynamic mechanical and tribological characterization of polymer blends, composites and nanocomposites

- Characterization of the thermal stability and crystallinity by thermal analysis

For further info, scan the QR code and visit our webpage:

Human & Material Resources

Human resources

Senior Researchers: Adriana Nicoleta Frone, CSI, Ph.D.; Zina Vuluga, CSI, Ph.D.; Denis Mihaela Panaitescu, CSI, Ph.D.; Cristian Andi Nicolae, CSI; Raluca Augusta Gabor, CSIII;

Young Researchers: one Master's student - Monica Cărăulașu, and four Ph.D. students: Cătălina Diana Ușurelu, Gabriela-Mădălina Oprică, Andreea Ioniță, George Mihail Teodorescu;

Technician: Dorian Radu.

Material resources

Synthesis and Processing

SFS-Buchi Glass Reactor

Freeze Dry System

Brabender Lab Station

Leistritz LSM 30.34

Mechanical, Thermal and Morphological Characterization

Injection Moulding Engel Victory 28/80

Testing Machine Instron 3382

HIT 5.5P Pendulum Impact Tester Zwick

Gas Permeability Lyssy Darsensor

DSC Q2000 TA Instruments

TGA Q5000IR

DMA Q800TA Instruments

Hysitron Triboindenter Premier

Bruker AFM Microscope

Projects

Latest R&D pursuits

1. Design of new nanocellulose-based gas-carrier systems CELGAS, PN-III-P4-PCE-2021-0435, 2022-2024;
2. Biopolymeric structures obtained by plasma treatment for wound healing BIOPLASM PN-III-P2-2.1-PED- 2021-2559, 2022-2024;
3. Ecological nanocomposites based on bio-PA and bio-fillers for injected auto parts ECONANO4AUTO PN-III-P2-2.1-PED-2021-0795, 2022-2024;
4. Improved holographic trademark making technology with encapsulated thermochromic system—HOLTERM PN-III-P2-2.1- PTE-2021-0339, 2022 -2024;
5. New materials based on polylactic acid with controlled flexibility – FLEX4PLA , PN-III-P1-1.1-TE-2019-1333, 2020-2022;
6. Emerging technologies for industrial valorisation of 2D structures (graphenes and non-graphenes), PN-III-P1 80PCCDI/2018;
7. New and emerging technologies for reducing the weight of cars and energy consumption (needed to reduce CO2 emissions);

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202 Splaiul Independenței Str., Bucharest, district 6, 060021, Romania

Phone: 0040-21-316.30.68
Fax: 0040-21-312.34.93
Email: office@icechim.ro

R&D services:

- Morphology of advanced nano-materials by TEM analysis;
- High Resolution TEM imaging;
- Scanning-TEM analysis using BF, DF and HAADF detectors;
- EDX spectroscopy for elemental identification and mapping in STEM mode;
- Electron Diffraction (ED) and Selected Area Electron Diffraction (SAED);
- Electron holography;
- Imaging of samples in cryogenic conditions (Cryo-TEM);
- Electron-tomography acquisition in TEM mode;
- Imaging by Single Particle Analysis (SPA) of cryo-fixed biological samples;
- 3D model reconstruction using dedicated software.

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RESEARCH TEAM 13

CRYO-TEM LABORATORY

Team leader:

Biochem. Florin OANCEA, Ph.D. Habil.

florin.oancea@icechim.ro

Excellence in Research

Expertise

The **CRYO-TEM ELECTRON MICROSCOPY TEAM** is mainly engaged in the characterization of materials and nanostructures at a sub-nanometer scale for applications in the study of interfaces at the atomic scale. Recent years have witnessed a huge evolution of the thematic of the group, as the investigation of nano-materials requires the development of new characterization methods and tools. In this regard, the team develops or optimizes new techniques related to TEM with the view to push boundaries on structural and chemical properties beyond, with the better resolution, but also to probe other physical properties of both biological samples as well as of nanomaterials and nanostructures.

With the equipment available on ICECHIM premises, the team has been able to develop novel methods to address important issues related to nanomaterials and nanostructures. We mainly focused on four new topics, always with the purpose to get quantitative information on structural, chemical and physical properties:

- Atomic imaging by Scanning TEM;
- Preparation of biological samples;
- Energy-dispersive X-ray (EDX) spectroscopy;
- Electron holography.

For further info, scan the QR code and visit our webpage:

Infrastructure

Leica EC FC 7 cryo-ultramicrotome:
Allows 80 nm sample strip thickness for epoxydic resins/polymeric materials. Softer polymeric samples can be cut in cryogenic conditions.

Leica EM KMR3 Glass Knife Maker:
The balanced break method of the device allow for glass knives customization for EM and LM applications .

Tecnai™ G2 F20 TWIN Cryo-TEM:
State-of-the-art transmission electron microscope with an extended task-oriented user interface, combining fast, efficient and simple operation with proven reliability to deliver a TEM platform that suits many applications needs—from basic, rapid sample screening to unique, sophisticated experiments requiring superior analytical capabilities. The flexibility to adjust acceleration voltage to any other value in a minute helps operate the Tecnai G2 20 always at optimum experimental conditions.

Gatan Turbo Pumping Station (Model 655):
This is used to keep the holders under vacuum when not in use thus minimizing the risk of contamination.

Fischione™ Instruments Plasma Cleaner (model 1020):
This is an essential tool for O_2/Ar mixture decontamination of holders that are exposed to cold plasma.

FEI Vitrobot™ Mark IV
Good vitrification is a crucial step within structural biology applications such as single particle analysis (SPA), cryo electron tomography (cryo-ET), and MicroED. The Thermo Scientific Vitrobot Mark IV System ensures that critical vitrification parameters can be kept constant, thereby allowing enhanced sample quality prior to imaging of the vitrified particles or cellular components.

Projects

Latest R&D Projects:

1. Prototype coating system to reduce the CO2 footprint and environmental impact in shipping – SPARACOM, PN-III-P2-2.1-PTE-2021-0675, 2022 – 2024;
2. Innovative fullerenol - hydrogels based nanomaterials for health diagnostic and care applications – FULSENS-GEL, COFUND-M-ERANET-3-FULSENS-GEL, 2022 – 2024;
3. Biogenic amines detection in food based on an innovative opto-electrosensitive platform – AMI-FOOD, PN-III-P2-2.1-PED-2021-1942, 2022 – 2024;
4. Foliar fertilizers with increased effectiveness – FORTIFOL, PN-III-P2-2.1-PTE-2021-0414, 2022 – 2024;
5. Ecotechnology for obtaining phytoingredients encapsulated in hydrogel based on bioactive complexes immobilized in a layer double hydroxide matrix – DUACTIVMER, PN-III-P2-2.1-PED-2021-1870, 2022 – 2024;
6. Strigolactone mimics as the active ingredient of a multifunctional plant biostimulant – RHIZOSTIM, PN-III-P2-2.1-PED-2021-2866, 2022 – 2024;
7. Synthetic nanogel antibodies molecularly imprinted with the spike s1 protein – ANTISPIKE, PN-III-P1-1.1-TE-2021-1239, 2022 – 2024;
8. Integrated use of the next generation plant biostimulants for an enhanced sustainability of field vegetable high residue farming systems – STIM4+, RO-NO-2019-0540, 2020 – 2023;

National Institute for R&D in Chemistry and Petrochemistry - ICECHIM Bucharest

202 Splaiul Independenței Str., Bucharest, district 6, 060021, Romania

Phone: 0040-21-315.32.99
Fax: 0040-21-312.34.93
Email: office@icechim.ro