

CERIC

Central European
Research Infrastructure
Consortium

Open for
Science

Open for Industry

Providing
advanced
solutions to
innovation
challenges

www.ceric-eric.eu

An innovation ecosystem offering high-level instruments and expertise for structural, molecular and atomic investigations on materials, biomaterials and nanomaterials, to meet critical safety and performance requirements and assess their capabilities and limitations, even in extreme conditions.

CERIC's Services to Industry

Research & development

- Access to state-of-the-art instruments and techniques for structural and dynamic characterization of materials. Send a request to the Industrial Liaison team and get a package tailored to your R&D needs.
- Contract Research: take part in advanced R&D projects on topics of your interest, to develop innovative solutions jointly.
- Joint Application in Projects: Benefit from CERIC's wide network and support, to find the right partners and funding instruments.

Training

Get training on advanced techniques and their applications in your industrial sector.

Spin-off & start-up support

Find the right link to innovation networks and communities, as well as incubators and accelerators throughout Europe.



CERIC supports the development of key enabling technologies in several sectors

Open for
Industry

Automotive and Aerospace

CERIC Partner Facilities provide support to the aerospace and automotive industries on advanced materials and devices to meet critical safety and performance requirements, assessing the capabilities and limitations of materials and systems even in extreme conditions.

- Components
- Manufacturing
- Composition, microstructure characterisation and behaviour of metals and alloys
- Catalysts, batteries and fuel cells
- Coatings, paintings and thin films
- Electrochemical systems, semiconductors, superconductors and topological insulators
- Polymers, composites and ceramics
- Defects and damages



Components

CERIC can carry out components' analysis with high precision techniques, investigating deep layers of matter (even inside a container or machine), surface roughness, irradiation damage, residual stresses and irregularities, also performing 2D and 3D imaging, even during operations. CERIC has the capacity to analyse various kinds of materials in solid, powder, liquid and pressurized gas forms where no reference materials exist.

Manufacturing

CERIC offers studies of the inside of large pieces of equipment, and inside vessels that have different conditions of pressure, temperature and environment applied for material manufacturing and testing (glass, ceramic, alloys). Fabricating high precision components that have to be coupled with precision systems, such as micro-gears, microparts for watches, microturbines and microfluidic channels, can also be carried out.

Composition, microstructure characterisation and behaviour of metals and alloys

CERIC performs microstructural and morphological characterisation of nanostructured materials: defining the composition, crystal structure, texture, shape on a nanometric scale, aggregation and thermal behaviour through residual stress test and defects. CERIC can also follow the evolution of alloy composition and microstructure during operation and study the distribution of two-phase systems such as metal alloys.

Catalysts, batteries and fuel cells

CERIC Partner Facilities can perform in-depth studies down to nanometer size of new materials applied to systems for renewable energy. Analyses of surface, interface and electronic properties and behaviour of catalysts, batteries and fuel cells can be done even during operation, including non-destructive probes. New materials for Li-ion batteries can be studied: composition of materials impurities and mixtures of polymorphs.

Coatings, paintings and thin films

Among other things, CERIC can provide support with depth profiling of coatings or thin and multilayers films down to micro and nano size, including composition and analysis of dispersion.

Electrochemical systems, semiconductors, superconductors and topological insulators

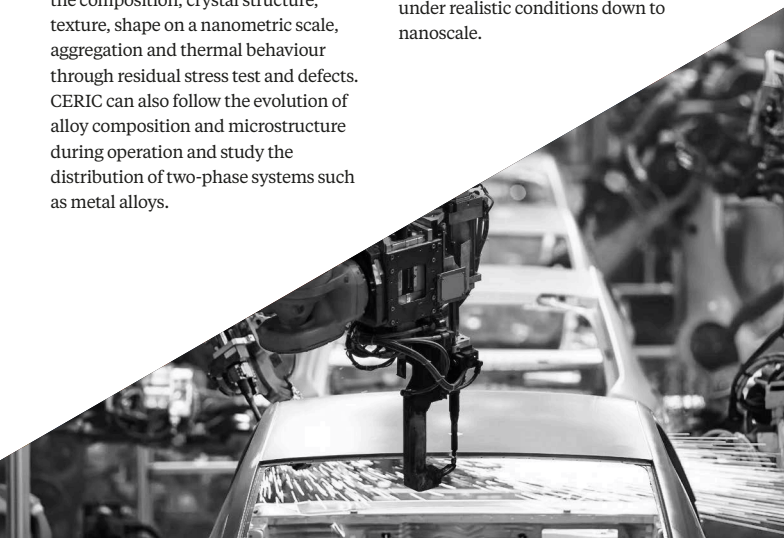
CERIC can offer studies of chemical and electronic properties and structure of materials such as semiconductors, high-temperature superconductors, topological insulators, low-dimensional materials and related devices. Electrochemical systems can also be studied in operando, including surface behaviour and surface interactions under realistic conditions down to nanoscale.

Polymers, composites and ceramics

CERIC offers high precision analyses to understand the composition, properties, behaviour and interactions of modern smart materials, which can have nanoscale structure (composites, polymers with or without nanofillers). CERIC defines aggregation and microstructural defects to solve issues related to material characteristics and why problems related to their functioning occur.

Defects and damages

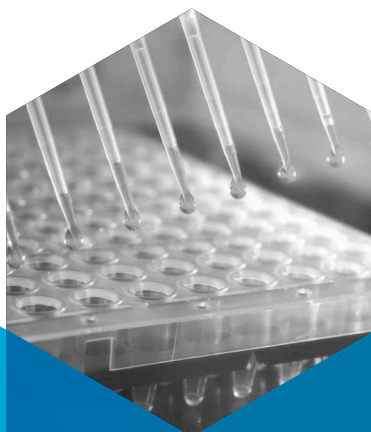
CERIC offers the analysis of microstructural defects, inhomogeneity of casted materials, water uptake of solids, analysis of artefacts and machines, as well as dynamic measurements to follow time-dependant processes. CERIC can test the corrosion of metals applied in extreme conditions and intolerance of shot blasting systems to metalworking fluids. Characterisation of individual aerosol particles collected on filters can be also carried out.



Pharmaceutical, Medical and Biotech

CERIC techniques can provide much more precise information on the molecular structure and behaviour of different materials and molecules. Among others, CERIC can help to understand variability in drugs and their behaviour, critical for addressing the problem of failing to identify effective drugs or to study biosimilars.

- Drugs and drug delivery systems
- Proteins
- DNA
- Medical and medical devices
- Catalysts characterisation and behaviour
- Biotechnology





Drugs and drug delivery systems

CERIC offers support in defining drug delivery systems, drug formulations and Active Pharmaceutical Ingredients (API), and interactions with excipients and release mechanisms in different kinds of formulations. Studies of new contrast media for the definition of new protocols in the medical field and in drug delivery are also available.

Proteins

CERIC can perform the identification and characterization of proteins (including protein complexes), even in the field of biosimilars, their size, agglomeration and dispersion (e.g. for drug delivery applications). CERIC can support high throughput production of recombinant proteins and the fabrication of protein nanoarrays.



DNA

Control studies on DNA to prevent cellular abnormalities, genetic diseases and the onset of cancer can be carried out. DNA's interaction with pharmaceutical compounds can also be determined.

Medical and medical devices

CERIC offers studies of new types of scaffolds functionalised with different types of cells. Studies of human organs, composition of stones, and mammographic imaging can also be provided, with a resolution of a few to hundreds of microns.

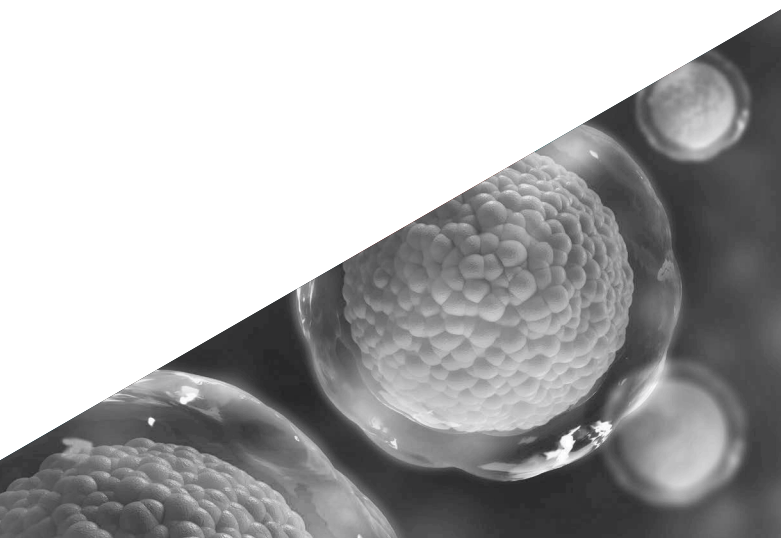


Catalysts characterisation and behaviour

Surface, interface and electronic properties and behaviour of catalysts can be defined. CERIC supports probing new catalysts at an atomic level and the way properties of catalysts change during operation following the evolution of components.

Biotechnology

Testing of biosensors' bio-functionalisation and defining the performance of biocompatible materials for virology, cellular biology or cancer research are offered.



Environment

Issues of environmental protection are gaining increasing importance. Every aspect of a material's usage, from extraction to production and disposal is now subject to environmental considerations. CERIC Partner Facilities also collaborate on systems and processes for analysis, monitoring and control of contaminant particles, nanoparticles and trace elements.

- Composition, structures and characterisation in environmental studies
- Removal solutions





Composition, structures and characterisation in environmental studies

CERIC Partner Facilities can detect, down to micro and nano resolution, trace elements and map molecular groups and structures in environmental studies, such as in plastic and microplastic pollution studies. CERIC can analyse and collect high-quality data from different types of materials for the analysis of soil and fertilizers and define the distribution of the absorption of light metals. CERIC offers support in the analysis of thin and multilayer films for process monitoring, composition and contaminant control.



Removal solutions

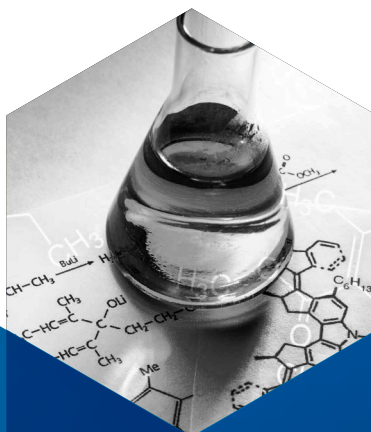
CERIC has the capabilities, through its techniques, to evaluate the effectiveness of pollutant removal solutions, such as to characterize individual aerosol particles collected on filters.



Chemical

Controlling structures at the micro- and nano-levels is essential for the chemical industry to develop new products and, at the same time, almost all chemical industries nowadays rely on development, selection and application of catalysts. CERIC Partner Facilities can offer their expertise on these key topics.

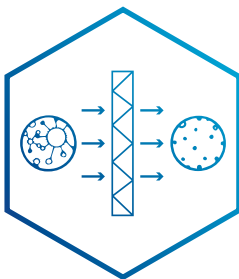
- Chemicals structures and dynamics
- Catalysts characterisation and behaviour
- Polymers, composites and ceramics





Chemicals structures and dynamics

CERIC can detect trace elements at high resolution, analyse the shape, size and density of nanoparticles, as well as determine the local structure, dynamics, reaction state and chemical environment within molecules. CERIC Partner Facilities offer support in the definition of surface and interface phenomena, obtaining morphological, chemical (elemental sensitivity) and magnetic properties with a resolution of a few dozen nanometres (e.g., in composites and clusters).



Catalysts characterisation and behaviour

Surface, interface and electronic properties and behaviour of catalysts can be analysed. Support in probing new catalysts at atomic level and the way properties of catalysts change during operation following the evolution of components is also offered. Moreover, CERIC supports understanding the diffusion behaviour of molecules in microporous materials for the design of separation membranes for catalysts.



Polymers, composites and ceramics

CERIC offers high precision analyses for understanding the composition, structure, properties, behaviour and interactions of modern smart materials, which can have a nanoscale structure (composites, ceramics, polymers, with or without nanofillers). CERIC defines aggregation and microstructural defects to solve issues related to material characteristics and the reasons why problems related to their functioning occur.



Textile

High tech solutions have become prominent in the textile sector over recent decades. New polymers with enhanced properties and nanomaterials are nowadays basic materials for the smart textile sector, and CERIC Partner Facilities can support research in this area.

- Polymers and smart materials
- Defects and damage
- Characterisation; damage and treatments



Polymers and smart materials

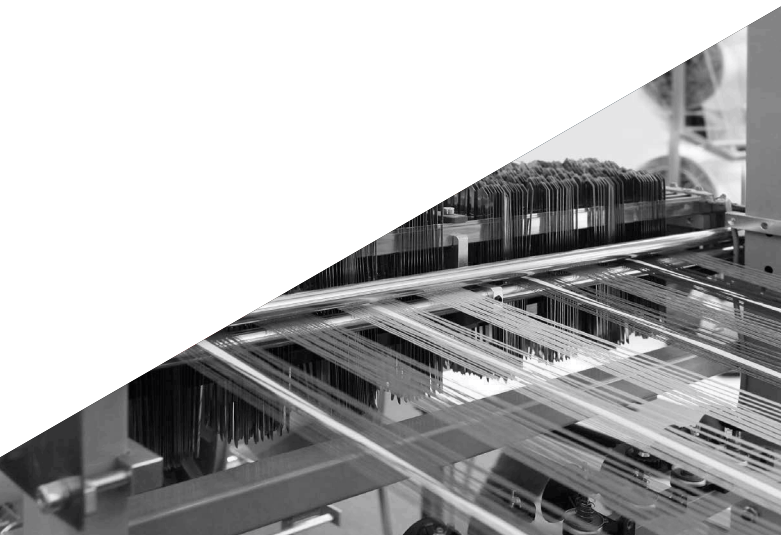
CERIC offers high precision analyses to understand the composition, properties, behaviour and interactions of modern smart materials, which can have a nanoscale structure (composites, polymers with or without nanofillers, synthetic polymers, polyamides and other materials for high-quality applications).

Defects and damage

CERIC can provide support in defining aggregation and microstructural defects of materials for solving issues related to material characteristics and the reasons why problems related to their functioning occur. For example, CERIC can analyse radiation damage and compound deposition (down to sub-micrometric resolution) in textiles used in high-risk sites.

Characterisation; damage and treatments

CERIC offers a unique combination of complementary techniques for the easier interpretation of structures and materials. CERIC Partner Facilities can provide support for the definition of the provenance and appropriate treatment for cleaning and conservation through, for example, high-resolution characterisation of metal threads or inorganic/metal pigments from liturgical vestments, folk costumes and paintings or the composition of antique coins. CERIC offers 3D tomographic imaging of objects with a resolution of a few to hundreds of microns, and 3-D imaging by thermal neutrons for bulky objects, in a non-destructive way, providing high-quality imaging inside objects. CERIC can also provide monitoring of material damage caused by exposure to radiation.



Paint and Coatings

Paint and coatings manufacturers are constantly seeking durable solutions that are easy to use and with enhanced properties. Structures of materials with dirt, rain and contaminant repellent properties have to be studied at micro and nanoscale, since this is directly linked to their end-use properties at the macro-scale. CERIC Partners have the facilities and skills to help refine production and manufacturing processes and understand micro- and nanostructures in these materials for higher end-product performance.

- Profiling of coatings
- Profiling of thin and multilayers films





Profiling

Among other things, CERIC can provide support with depth profiling of coatings or thin and multilayers films down to micro and nano size, including composition, analysis of dispersion and characterization of inorganic/metal pigments.

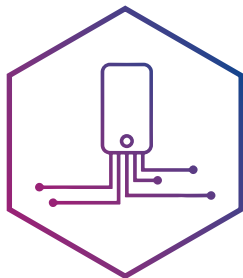


Optoelectronics

Enhanced conductive and magnetic properties of materials and miniaturisation are areas on which industry is focusing its efforts to come up with better innovations and inventions. CERIC Partner Facilities can offer extensive knowledge and a wide range of solutions for materials development in this area.

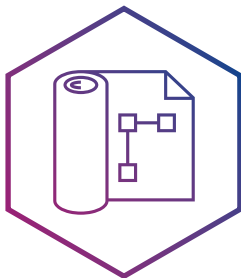
- Structure and behaviour of electrochemical systems and devices, semiconductors, superconductors and graphene systems
- Composition, structure and microstructural defects of thin films/ thin layers





Structure and behaviour of electrochemical systems and devices, semiconductors, superconductors and graphene systems

CERIC provides studies of chemical and electronic properties and structure – down to sub-micrometre size – of materials such as semiconductors, high-temperature superconductors, topological insulators, low-dimensional materials and related devices. Electrochemical systems can also be studied in operando. CERIC offers analysis, down to nanoscale, of the surface behaviour, in-surface interactions and interface phenomena in electrochemical systems and semiconductors under realistic conditions. CERIC carries out research on induced graphene superconductivity and graphene acquisition of functionalities beyond its intrinsic properties that can be used for possible spintronic applications.



Composition, structure and microstructural defects of thin films/thin layers

Among other types of investigations, CERIC offers its expertise in the characterisation of thin (but also thick) films, their quality, composition, deposition and microstructural defects. CERIC Partner Facilities can offer structural measuring of thin films or liquid surfaces, providing detailed information on the near-surface structure, including thin films layered on a substrate and multilayers for UV mirrors, giant magnetic resistance and magnetic recording.



Metal/Metallurgy

CERIC can support the study of intelligent multi-functional properties for metal components at nano and micro-scale to define new grades of metals and alloys with higher strength, formability and corrosion resistance.

- Microstructure characterisation and behaviour of metals and alloys
- Defects and damages





Microstructure characterisation and behaviour of metals and alloys

CERIC performs microstructural and morphological characterisation of nanostructured materials: defining the composition, crystal structure, texture, shape on the nanometric scale, aggregation and thermal behaviour through residual stress test and defects.

CERIC can also follow the evolution of alloy composition and microstructure during operation and study the distribution of two-phase systems such as metal alloys.



Defects and damages

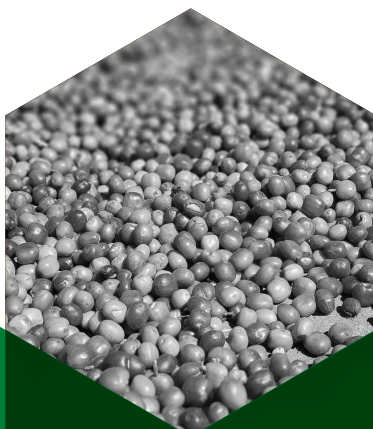
CERIC offers the analysis of inhomogeneity of casted materials, water uptake of solids, artefacts and machines, as well as dynamic measurements to follow time-dependant processes. CERIC can test the corrosion of metals applied in extreme conditions and the intolerance of shot blasting systems to metalworking fluids.



Food

Technology is playing an increasingly important role in food production and advances are required from across the full spectrum of food research. For that, CERIC Partner Facilities can provide support from molecular and microstructural definition and novel processing methods, to quality control, microbiological safety issues and advances in preservation.

- Composition, microstructure characterisation and behaviour of food
- Proteins
- Defects and damages





Composition, microstructure characterisation and behaviour of food

CERIC can provide very specific information about the relative concentration of components (e.g., in edible fats and oils) and it is able to determine trace element composition, and map molecular groups and structures on the nanoscale. CERIC Partner Facilities are able to define the pore structure of samples, for example in freeze-dried vegetables, and the diffusion behaviour of molecules in microporous materials.



Proteins

CERIC provides support in defining protein size and agglomeration, and specific interactions of proteins embedded in matrixes (e.g., glassy sugar matrixes).

Defects and damages

CERIC can monitor radiation damage in various materials, including food.



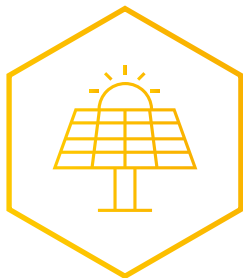
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Energy

CERIC provides support in the development of novel materials with advanced properties to be applied to the newest systems, such as the latest fuel cells, solar cells and batteries.

- Catalysts, batteries, fuel and solar cells
- electrochemical systems, semiconductors, superconductors and topological insulators
- Oil





Catalysts, batteries, fuel and solar cells

CERIC realizes in-depth studies down to nanometre size of new materials, applied to systems for renewable energy such as solar cells. Surface, interface and electronic properties and behaviour of catalysts, batteries and fuel cells can be defined even during operation and support can be provided for probing new catalysts at atomic level. Non-destructive tests can be also performed.

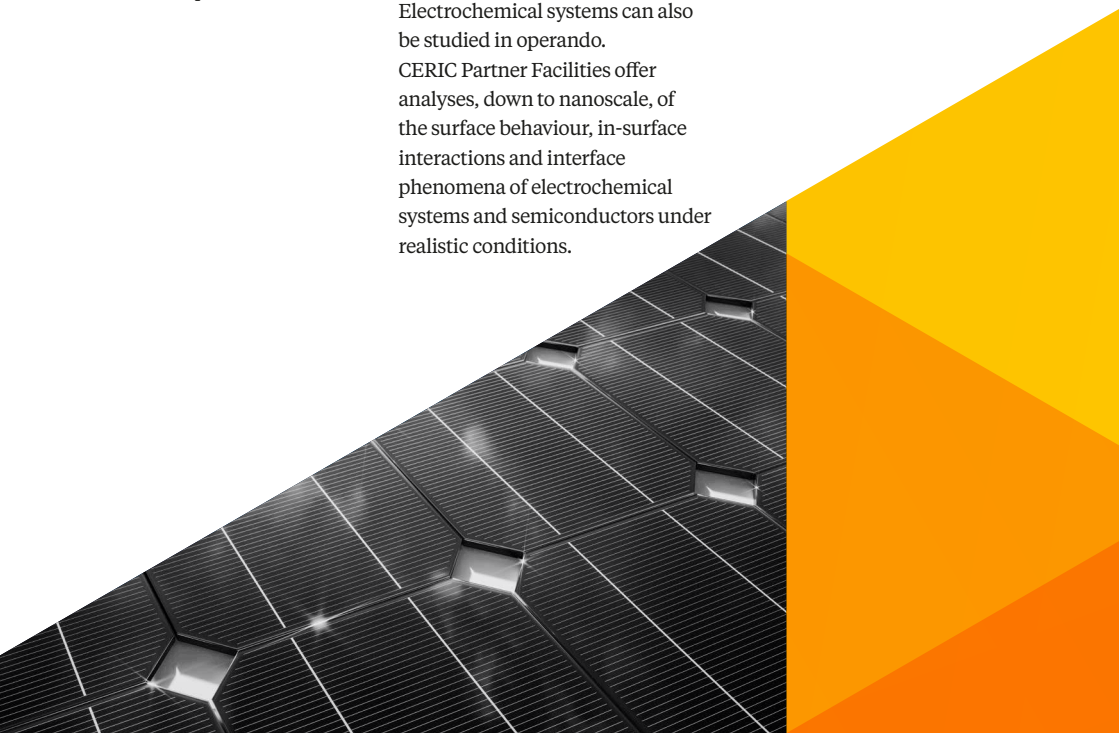
Electrochemical systems, semiconductors, superconductors and topological insulators

Studies of chemical and electronic properties and structure of materials such as semiconductors, high-temperature superconductors, topological insulators, low-dimensional materials and related devices can be carried out. Electrochemical systems can also be studied in operando.

CERIC Partner Facilities offer analyses, down to nanoscale, of the surface behaviour, in-surface interactions and interface phenomena of electrochemical systems and semiconductors under realistic conditions.

Oil

CERIC can also focus on the analysis of components (e.g., absorbers) during an oil press process. High-quality data of oil samples for the petrochemical industry are also offered.



Cultural heritage

CERIC Partner Facilities can support cultural heritage conservation, offering a wide set of complementary characterisation techniques, essential due to the complexity and heterogeneity of samples. CERIC offers low or non-destructive analytical methods and provides information from atomic to the structural level of samples.

- Characterisation; damage and treatments





Characterisation; damage and treatments

CERIC offers a unique combination of complementary techniques for the easier interpretation of structures and materials. CERIC Partner Facilities can provide definition of the provenance and the appropriate cleaning and conservation treatment through, for example, high-resolution characterisation of metal threads or inorganic/metal pigments from liturgical vestments, folk costumes, paintings or the composition of antique coins.

CERIC offers 3D tomographic imaging of objects with a resolution of few to hundreds of microns, and 3-D imaging by thermal neutrons for bulky objects, in a non-destructive way, providing high-quality imaging inside objects.

CERIC can also provide monitoring of material damage caused by exposure to radiation.



CERIC's Partner Facilities

Scattering at the TU Graz

Grad (Austria) and Trieste (Italy)

www.tugraz.at

Ion beams at the Institute Ruđer Bošković

Zagreb (Croatia)

www.irb.hr

Surface analysis at the Charles University

Prague (Czech Republic) and Trieste (Italy)

www.cuni.cz

Neutrons at the Budapest Neutron Centre

Budapest (Hungary)

www.bnc.hu

Synchrotron beamlines at Elettra

Trieste (Italy)

www.elettra.eu

Synchrotron beamlines at SOLARIS

Krakow (Poland)

www.synchrotron.uj.edu.pl

Electron microscopy and EPR at the National Institute of Materials Physics

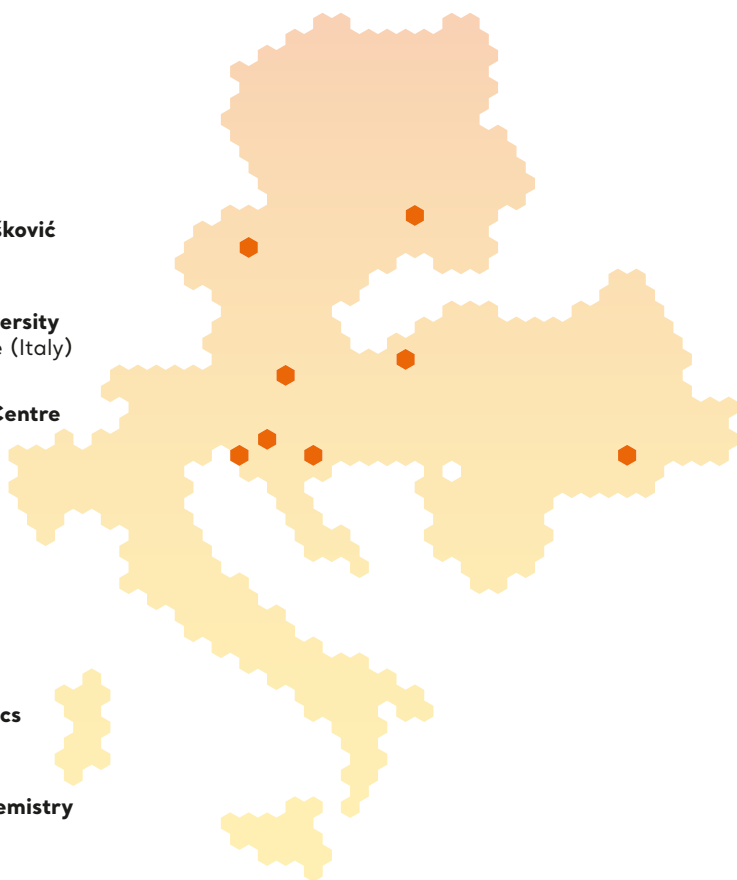
Magurele (Romania)

lab50.infirm.ro

NMR at the National Institute of Chemistry

Ljubljana (Slovenia)

www.nmr.ki.si



For more information, contact CERIC's Industrial Liaison Office (ILO) at: ilo@ceric-eric.eu

ACCELERATE is funded by the European Union
Framework Programme for Research and Innovation
Horizon 2020, under grant agreement 731112



CERIC-ERIC - Statutory Seat
S.S. 14 - Km 163,5 in AREA Science Park
34149 - Basovizza, Trieste
Italy

www.ceric-eric.eu