

ICSTM

INSTITUTE OF MULTIDISCIPLINARY RESEARCH FOR SCIENCE AND TECHNOLOGY

MULTIDISCIPLINARY RESEARCH INFRASTRUCTURE SERVICES FOR INNOVATION

APPLIED RESEARCH

ADVANCED INFRASTRUCTURE

HIGH PERFORMANCE EQUIPMENT

IMPACT DRIVEN RESULTS

PARTNERSHIP AND COLLABORATION

I Integrated knowledge

C Collaborative research

S Sustainable innovation

T Technological excellence

M Measurable impact

APPLIED RESEARCH | ADVANCED INFRASTRUCTURE | COLLABORATION AND PARTNERSHIPS | INNOVATION AND IMPACT | FOR SOCIETY AND ECONOMY

INSTITUTE OF MULTIDISCIPLINARY RESEARCH FOR SCIENCE AND TECHNOLOGY

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VALAHIA UNIVERSITY OF TARGOVISTE
INSTITUTE OF MULTIDISCIPLINARY RESEARCH FOR SCIENCE AND TECHNOLOGY

MISSION AND STRATEGIC DIRECTION

ICSTM coordinates multidisciplinary research, advanced infrastructure and innovation-oriented collaboration within Valahia University of Târgoviste.



ABOUT ICSTM

ICSTM – is the research structure of Valahia University of Târgoviște dedicated to coordinating, supporting and developing scientific research, experimental development, innovation and technology transfer.

Established in 2003, ICSTM brings together institutionally accredited research centers, advanced laboratories and multidisciplinary teams, supporting national and international projects, research services and collaborations with academic, institutional and economic partners.











MISSION

To support multidisciplinary research and innovation through advanced infrastructure, scientific expertise and relevant services for academia, industry and society.

VISION

ICSTM aims to consolidate its position as a nationally and internationally recognized hub for applied research, technological services, strategic partnerships and sustainable innovation.

STRATEGIC DIRECTIONS

- Advanced research infrastructure
- Research and technological services
- Multidisciplinary excellence
- National and international partnerships
- Innovation and technology transfer
- Young researchers and doctoral training

WHAT WE OFFER

Integrated research services, advanced infrastructure and multidisciplinary expertise for applied science, innovation and technological development.

ICSTM OFFERS:

1. ACCESS TO ADVANCED RESEARCH INFRASTRUCTURE

Access to laboratories, platforms and high-performance equipment for scientific research, experimental development and innovation-oriented projects.

2. ANALYSIS AND CHARACTERIZATION SERVICES

Specialized services for the investigation of materials, samples, structures and systems using advanced analytical, microscopic, spectroscopic and elemental techniques.

3. EXPERIMENTAL TESTING AND FUNCTIONAL VALIDATION

Testing under controlled conditions for evaluating performance, reliability, mechanical behaviour, functional properties and technological applicability.

4. PROTOTYPING AND SOLUTION DEVELOPMENT

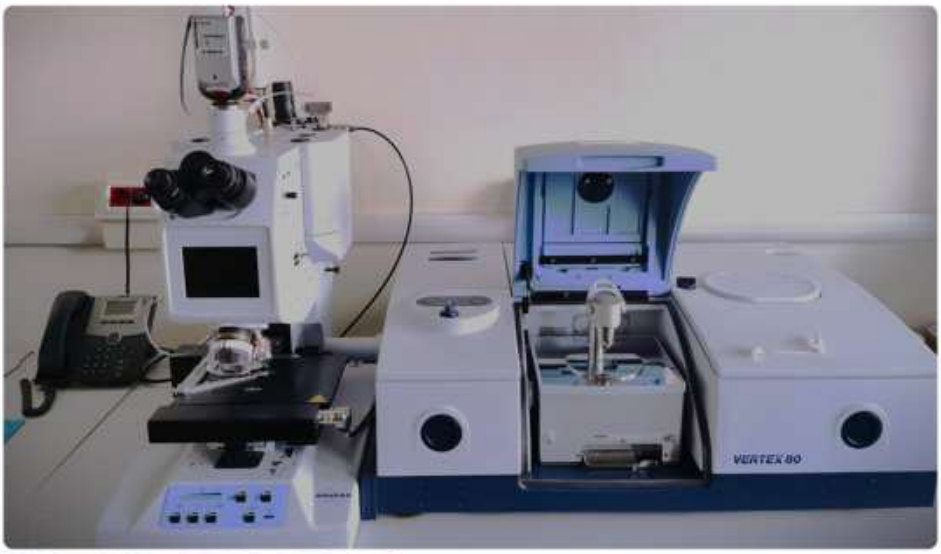
Support for design, prototyping, machining, digital fabrication and development of experimental or technological solutions.

5. SUPPORT FOR R&D AND INNOVATION PROJECTS

Scientific, technical and institutional support for research-development-innovation projects, academic collaborations and partnerships with industry.

6. MULTIDISCIPLINARY EXPERTISE

Access to specialized teams from multiple scientific domains, integrated in collaborative workflows focused on measurable results.















WHO BENEFITS:

UNIVERSITIES AND RESEARCH INSTITUTES

Partnerships for research, innovation, doctoral training and joint scientific development.

INDUSTRIAL COMPANIES AND INNOVATIVE SMEs

Analytical, experimental and technological support for products, materials, processes and new technologies.

PUBLIC AUTHORITIES AND INSTITUTIONS

Scientific and technological support for projects, evidence-based decisions and institutional development.

PROJECT TEAMS, DOCTORAL STUDENTS, RESEARCHERS AND INTERNATIONAL PARTNERS

Access to expertise, infrastructure and collaboration opportunities for advanced research and innovation projects.

VALAHIA UNIVERSITY OF TARGOVISTE
INSTITUTE OF MULTIDISCIPLINARY RESEARCH FOR SCIENCE AND TECHNOLOGY

COMPETENCY DOMAINS

ICSTM supports multidisciplinary research across natural, applied, formal, social and human sciences, connecting scientific expertise, advanced infrastructure and collaborative research capacity.

1 NATURAL SCIENCES

- Chemistry
- Physics

Research activities focused on the understanding, analysis and characterization of physical and chemical processes, materials, samples and systems.

2 APPLIED SCIENCES

- Engineering

Applied research, technological development, experimental validation, prototyping and engineering solutions for research and industrial applications.

3 INTERDISCIPLINARY SCIENCES

- Materials science
- Environmental science

Integrated approaches to advanced materials, environmental analysis, sustainability, functional systems and applied multidisciplinary research.

4 FORMAL SCIENCES

- Computer Science
- Mathematics

Computational methods, data analysis, mathematical modeling, simulation and digital support for scientific and technological research.

5 SOCIAL SCIENCES

- Economics
- Law
- Political science

Research on economic, legal, institutional and political processes, supporting evidence-based decisions, governance and societal development.

6 HUMANITIES

- Geography
- History
- Languages and literature
- Philisophy
- Sport
- Theology

Humanistic and cultural research addressing heritage, identity, communication, ethics, education, human performance and interdisciplinary dialogue.

7 ARTS

- Performing arts
- Visual arts

Creative, cultural and artistic research connected to visual expression, performance, cultural heritage and interdisciplinary innovation.

ICSTM brings together research centers, laboratories and multidisciplinary teams, supporting scientific research, experimental development, innovation and technology transfer across priority fields of competence.

RESEARCH CENTERS

ICSTM brings together multidisciplinary research capacity through the research centers of Valahia University of Targoviste.

1	Center for Political Science and Communication Research	Director: Lecturer PhD **Pompiliu ALEXANDRU**
2	Center for Food Science and Emerging Technologies in Environmental Engineering	Director: Associate Professor PhD **Elena BARASCU**
3	Academic School of Materials Science Research Center	Director: Professor PhD **Vasile BRATU**
4	Interdisciplinary Research Center Faith-Science-Mission "St. Apostle Paul"	Director: Lecturer PhD **Sorin BUTE**
5	Research Center in Electrical, Electronic and Information Technology Engineering	Director: Professor PhD **Dinu COLTUC**
6	Research and Studies Center in Accounting and Finance	Director: Professor PhD **Dan Marius COMAN**
7	Research and Studies Center in Management and Marketing	Director: Professor PhD **Gabriel CROITORU**
8	TRIDENT Research Center	Director: Associate Professor PhD **Emil Mihai DIACONU**
9	Research Center in Legal and Administrative Sciences	Director: Associate Professor PhD **Ilioara GENOIU**
19	Research Center for Interdisciplinary Archaeology, Medieval Studies and Heritage Studies	Director: Professor PhD **Marian COSAC**
10	7INOTECH Research Center	Director: Senior Researcher III PhD **Anca Irina GHEBOIANU**
11	Research and Innovation Center in Educational Sciences "I.T Radu"	Director: Professor PhD **Gabriel GORGHIU**
12	Research Center "Nanomaterials for Mechanical Microsystems"	Director: Professor PhD **Rodica Mariana ION**
13	Research Center "Energy-Environment Research Department"	Director: Senior Researcher III PhD **Gabriela MANTESCU**
14	Research Center for the History of International Relations and Cultural Heritage "Grigore Gafencu"	Director: Professor PhD **Monica MARGARIT**
15	Research Center in the Field of Electric Vehicles	Director: Associate Professor PhD **Oliver MAGDUN**
16	Research Center for the Study of Environment, Habitat, Motor Activities and Leisure Time	Director: Professor PhD **Constantin PEHOIU**
17	Research Center "Applied Sciences and Modern Technologies"	Director: Associate Professor PhD **Claudia STIHI**
18	Research and Expertise Center for Natural Resources and Environment	Director: Professor PhD **Gabriela TEODORESCU**
20	Center for Environmental Resilience, Eco-technologies and Sustainable Agro-systems	Director: Professor PhD **Daniel Emil Constantin DUNEA**

The research centers of Valahia University of Targoviste represent the institutional framework that supports scientific research, experimental development, innovation and technology transfer, in close collaboration with national and international partners.

VALAHIA UNIVERSITY OF TARGOVISTE
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REPRESENTATIVE RESEARCH INFRASTRUCTURE

ICSTM provides access to advanced laboratories, research platforms and specialized facilities supporting applied research, technological services, experimental validation and multidisciplinary collaboration.

01 ENERGY, PHOTOVOLTAICS AND ELECTRICAL MEASUREMENTS

Representative infrastructure:

- Solar simulator (Class AAA)
- IQE-200 measurement system
- Photovoltaic testing platforms
- Energy analyzer, oscilloscope
- Thermal imaging systems

Applications:

- Photovoltaic cell testing
- Quantum efficiency
- Electrical measurements
- Thermal inspection
- Power quality analysis and energy performance evaluation

02 PHYSICAL, STRUCTURAL AND CHEMICAL CHARACTERIZATION

Representative infrastructure:

- XRD, WDXRF, ICP-MS
- FTIR, Raman, UV-VIS, NMR
- Thermal Analysis System (DSC 3-STARe)
- AAS and atomic systems
- Analytical and preparation systems

Applications:

- Material composition
- Phase identification
- Structural analysis
- Spectroscopy
- Elemental and trace analysis

03 PROTOTYPING, MACHINING AND TESTING

Representative infrastructure:

- 5-axis CNC machining center
- CNC turning center
- Laser ablation and stereolithography
- MTS Bionix testing system
- 3D scanning and metrology

Applications:

- Prototype development
- Mechanical testing
- Digital fabrication
- Precision machining
- Functional validation

04 CHIMICAL AND ENVIROMENTAL LABORATORIES

Representative infrastructure:

- Enviromental analysis systems
- Digestors and reactors
- Incubators and biochemistry equipment
- Chromatography-related facilities

Applications:

- Environmental monitoring
- Chemical testing
- Sample preparation
- Analytical research

05 RADIO-TV, IT AND DIGITAL COMMUNICATION LABORATORY

Representative infrastructure:

- IT systems and workstations
- Radio-TV laboratory
- Audio-video production equipment
- Broadcast and communication technologies
- Data storage and networking

Applications:

- Digital content production
- Communication research
- Media analysis
- Educational resources
- Institutional dissemination

06 DOSIMETRY AND SAFETY MEASUREMENT LABORATORY

Representative infrastructure:

- Dosimetry laboratory
- Radiation measurement systems
- Gamma spectrometry
- Personal and environmental monitoring equipment
- Safety and protection systems

Applications:

- Dosimetric evaluation
- Radiation-related measurements
- Environmental safety
- Specialized laboratory testing

07 ECONOMICS, SOCIAL SCIENCES AND INTERDISCIPLINARY RESEARCH FACILITIES

Representative infrastructure:

- Economics laboratory
- Data analysis and statistics systems
- Social research facilities
- Survey and evaluation tools
- Interdisciplinary research spaces

Applications:

- Economic analysis
- Institutional and social studies
- Management research
- Policy support
- Project evaluation and decision-support activities

08 MICROSCOPY, NANOANALYSIS AND ARCHAEOLOGICAL MICROSCOPY

Representative infrastructure:

- SEM SU-70 with EDS/WDS/EBL
- AFM, nanoindenter
- Optical microscopy systems
- Archaeological microscope
- Sample preparation facilities

Applications:

- Surface morphology
- Micro- and nanoscale characterization
- Elemental mapping
- Local mechanical properties
- Heritage-object investigation

The infrastructure of ICSTM supports excellence in research and development, innovation, technology transfer and high-quality services for society and the economy.

A NANOMATERIALS AND NANOTECHNOLOGIES

1 SCANNING ELECTRON MICROSCOPE (SEM) SU-70 COUPLED WITH ENERGY DISPERSIVE SPECTROMETER (EDS), WITH WAVELENGHT DISPERSIVE SPECTROMETER (WDS) AND E-BEAM LITOGRAPHY SYSTEM (EBL)

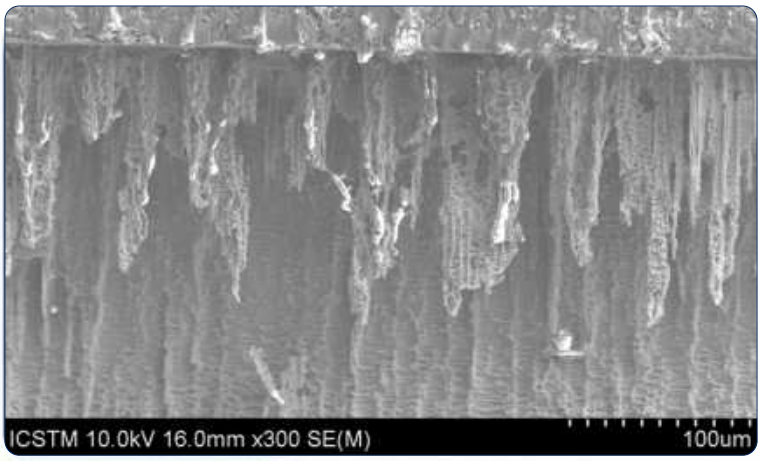
The Scanning Electron Microscope (SEM) SU-70 (manufactured by Hitachi, Japan) is a very sensitive research equipment, with field emission, and is based on a Schottky electron source. SU-70 includes several modules required for surface analysis of materials; for processing materials nanolithography (EBL), energy dispersive spectrometry (EDS) and wavelength dispersive spectrometry (WDS). All these modules are attached to the equipment.

The accelerating voltage (Vacc) may vary from 0.1 kV to 30 kV. SEM magnification range of 30X-800.000X and resolution at 15 kV acceleration voltage is 1 nm. EDS spectrometer attached allows qualitative and quantitative analysis (from Be (Z = 4) to Pu (Z = 94) on the point, rectangle, circle or the free choice and multiple choice line analysis, X-ray mapping, solutions to overlapping peaks. WDS spectrometer attached allows qualitative and quantitative analysis (from B (Z = 5) to Pu (Z = 94)).

Applications field of SEM (coupled with EDS, WDS and EBL) is wide: characterization of micro- and nanomaterials, qualitative and quantitative analysis of samples, electron beam lithography and the achievement of "lab-on-chip" etc.



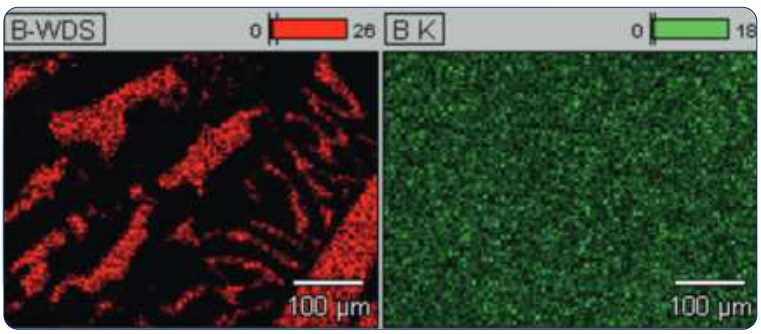
Hitachi SU-70 SEM workstation.



Surface morphology imaging (secondary electrons).

Applications:

- ✓ **surface morphology imaging (secondary electrons) – SEM;**
- ✓ **surface topography imaging and compositional contrast (secondary and backscattering electrons) – SEM+BSE;**
- ✓ **elemental analysis and elements distribution on sample surface – EDS+WDS.**



Chemical map obtained by WDS.

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A NANOMATERIALS AND NANOTECHNOLOGIES

2 NANO INDENTER AGILENT G200

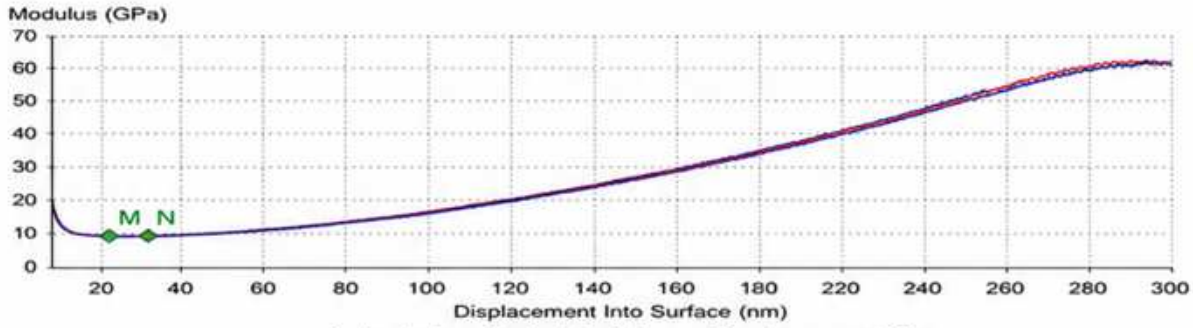


Nanoindenter Agilent G200 is an instrument for indentation and scratch tests, thus mechanical properties can be determined for a wide range of materials including metals, composites, ceramics, polymers, fibers, thin films.

Nano Indenter Agilent G200 is the world's most accurate, flexible and user-friendly instrument for nanoscale mechanical testing. Electromagnetic actuation allows the Nano Indenter G200 to achieve unparalleled dynamic range in force and displacement.

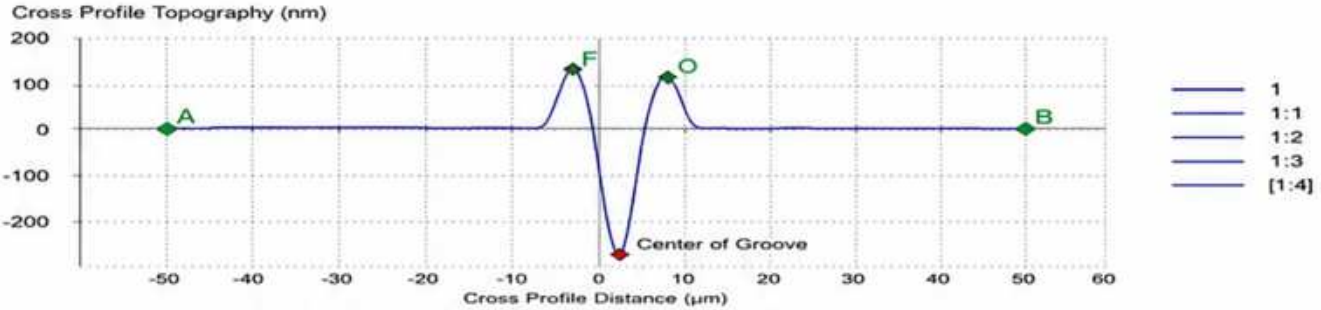
Load capacity can be expanded to 500 mN, maximum depth of indentation 500 µm, load resolution is ≤ 50 nN, force at contact ≤ 10 µN, scratching maximum distance > 100 mm and speed of scratching - 100 nm/s to 2 mm/s.

Nanoindentation is a technique for measuring mechanical properties such as hardness and elastic modulus of small volumes of materials. A tiny tip of very precise geometry is made to press into a sample using a small load in order to make minute indentations on the sample. The load applied and the depth of penetration of the tip into the surface are measured in real-time during the indentation process. As the geometry of the indenter tip is known, the data recorded can be analysed to determine the indentation area. From these analyses, the mechanical properties of the sample can be measured.



Indentation Test: Modulus – Displacement Curve

Test method according to ISO 1457. The samples used in indentation and scratch tests can have a maximum size of the sample: ø30 × 10 mm.



Scratch Test : Cross Profile Topography – Cross Profile Distance Curve

APPLICATIONS:

- ✓ semiconductor, thin films, MEMs (wafer applications);
- ✓ hard coatings, DLC films;
- ✓ composite materials, fibers, polymers;
- ✓ metals, ceramics;
- ✓ biomaterials, biology.

A NANOMATERIALS AND NANOTECHNOLOGIES

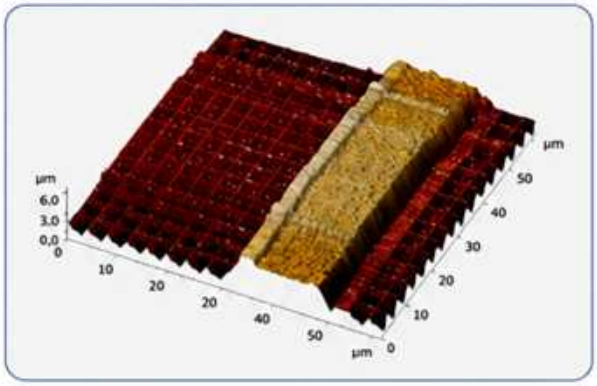
3 ATOMIC FORCE MICROSCOPE (NTEGRA PRIMA BY NT-MDT)



The device is capable of performing more than 40 measuring methods, which allows analyzing physical and chemical properties of the surface with high precision and resolution. It is possible to carry out experiments in air, as well as in liquids and in controlled environment. The new generation electronics provides operations in high-frequency (up to 5 MHz) modes. By AFM three-dimensional images of surfaces can be obtained (insulators or conductors) with a nano resolution in the lateral plane and subangstrom vertically. This device is used in basic research as well as on larger scale in the industry where it has a special role in the development of nanotechnology. AFM is the most used technique of the Surface Scanning Microscopy (SPM).

There are several scanning types implemented in NTEGRA Prima: scanning by the sample, scanning by the probe and dual-scanning. On account of that, the system is ideal for investigating small samples with ultra-high resolution (atomic or molecular level) as well as for big samples and scanning range up to 100 × 100 × 10 µm.

Built-in three axes closed loop control sensors trace the real displacement of the scanner and compensate unavoidable imperfections of piezoceramics as non-linearity, creep and hysteresis. The sensors, which are used by NT-MDT, have the lowest noise level, thus allowing working with closed loop control on the very small fields (down to 10 × 10 nm). NTEGRA Prima has a built-in optical system with 1 µm resolution, which allows imaging the scanning process in real-time.



MEASURING MODES AND TECHNIQUES

In air & liquid:

- ✓ **AFM (contact + semi-contact + non-contact) / Lateral Force Microscopy / Phase Imaging / Force Modulation / Adhesion Force Imaging / Lithography: AFM (Force);**

In air only:

- ✓ **STM / Magnetic Force Microscopy / Electrostatic Force Microscopy / Scanning Capacitance Microscopy / Kelvin Probe Microscopy / Spreading Resistance Imaging / Lithography: AFM (Current), STM / AFAM (optional).**

APPLICATIONS

- ✓ **biology and biotechnology;**
- ✓ **proteins, DNA, viruses, bacteriums, tissues;**
- ✓ **materials science;**
- ✓ **surface morphology, surface morphology, local piezoelectric properties, local adhesion properties, local tribological properties;**
- ✓ **magnetic materials;**
- ✓ **magnetic domain structure visualization, observation of magnetization reversal processes that depend on external magnetic field, observation of magnetization reversal processes under different temperatures;**
- ✓ **semiconductors, electric measurements;**
- ✓ **polymers and thin organic films;**
- ✓ **data storage devices and medias: CD, DVD disks, storages for terabit memories with thermomechanical, electric, and other types of recording;**
- ✓ **nanomaterials;**
- ✓ **nanostructures.**

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A NANOMATERIALS AND NANOTECHNOLOGIES

4 MICROSCOPE AXIO IMAGER M2M

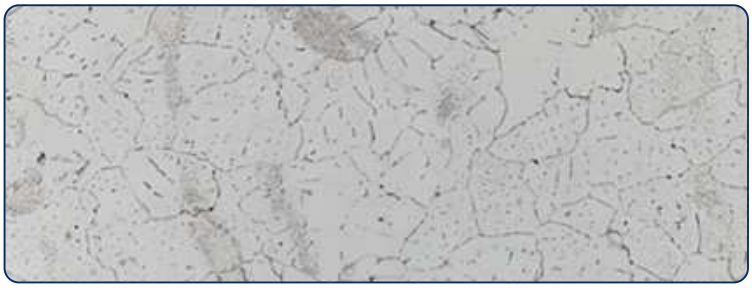


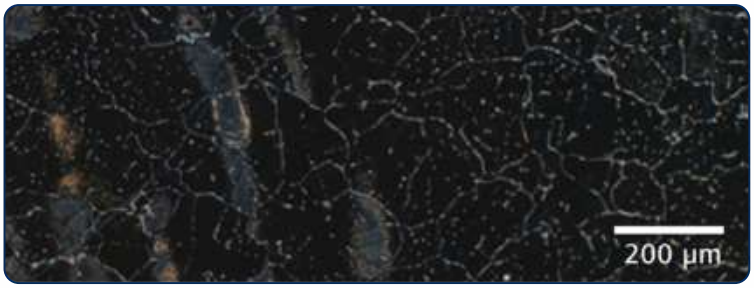
Research microscope for examination of specimens by transmitted light brightfield, phase contrast and bright field incident light and dark fluorescence, Axio Imager M2M combines high quality optics and bright fluorescence to provide clearer images. Contrast control and light provides certainty using the microscope in different ways and obtaining reproducible results. It is designed as a platform dedicated to applications in cell biology, neuroscience, molecular genetics and pathology.

The device is equipped with a motorized stand for sample, motorized epifluorescence objectives (5X–100X) plus camera and software that allows the microscope to be optimally used for different applications with maximum efficiency and comfort.

ADVANTAGES:

- ✓ **an optimized operating concept;**
- ✓ **improved optics with superb contrast and excellent resolution;**
- ✓ **forward-looking stand concept for upgradeability;**
- ✓ **innovative design for maximum stability and vibration-free work;**
- ✓ **an integrated system approach for digital imaging;**
- ✓ **it can retain more profiles for multiple users preferences.**





A NANOMATERIALS AND NANOTECHNOLOGIES

5 MICROSCOPE PRIMO STAR



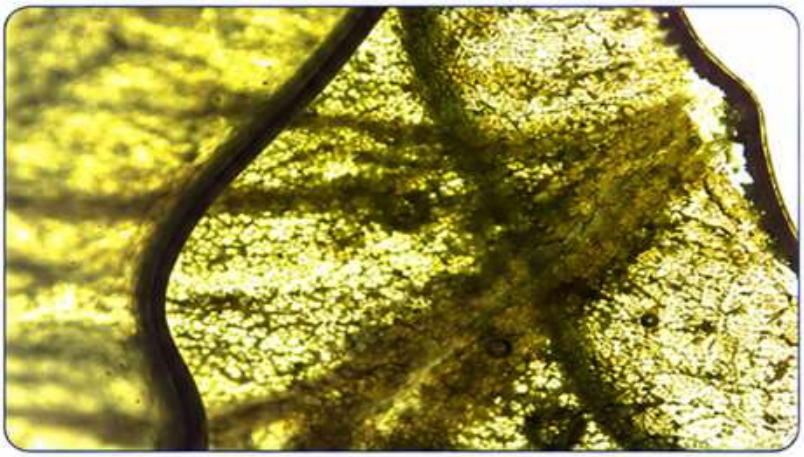
Primo Star has been developed with long-term use and great durability in mind. It incorporates all of ZEISS's experience in optical microscopy adapted to the most sophisticated environmental conditions in classroom settings and laboratory work.

Together with its many practical accessories, Primo Star can be used for education, in the laboratory, doctors' practice field.

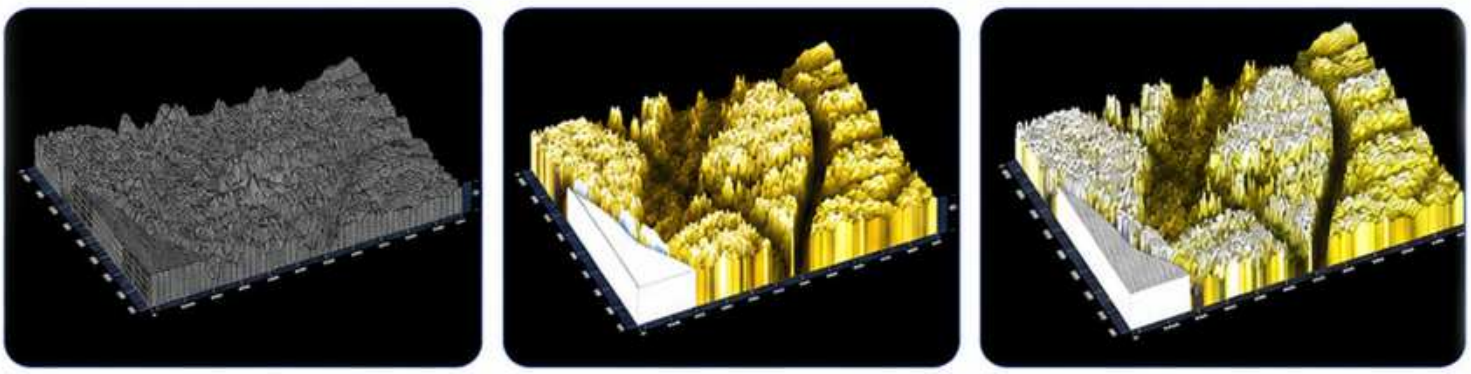
It offers the possibility to investigate the samples in transmitted light at a magnification between 4X and 100X. Optional, to the equipment it can be attached a digital video camera (Axiocam 105) which, by the microscope software allows real-time data acquisition. The obtained images could easily be converted from 2D format in 3D through its software for a better viewing.

ADVANTAGES:

- ✓ **easy to operate;**
- ✓ **robust and durable;**
- ✓ **quality optics from ZEISS;**
- ✓ **modular illumination concept;**
- ✓ **5-step LED-display intensity indicator panel on both sides of stand;**
- ✓ **all functions can be learned quickly;**
- ✓ **suitable for education and routine work in all areas of microscopy.**



2.5D images of walnut membrane



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A NANOMATERIALS AND NANOTECHNOLOGIES

6 KEYENCE VHX-X1 DIGITAL MICROSCOPE IN ARCHAEOLOGICAL RESEARCH

The Keyence VHX-X1 digital microscope represents a significant technological advancement within archaeology, offering a versatile, high-resolution imaging platform capable of generating both two-dimensional photographic documentation and three-dimensional topographical models of archaeological surfaces. The instrument's multi-modal imaging capabilities - encompassing coaxial illumination, optical shadow effect modes, High Dynamic Range (HDR) imaging, and 3D Height/Color mapping - collectively afford researchers an unprecedented level of analytical precision, rendering it an indispensable tool across numerous sub-disciplines of contemporary archaeological investigation.

The VHX-X1 microscope is equipped with a proprietary high-definition optical system capable of achieving magnifications ranging from 20 x to 2000 x, depending upon the lens configuration employed. In archaeological applications, working magnifications of 20 x to 500 x are most commonly utilised, as this range encompasses the scales pertinent to the observation of macroscopic surface features, use-wear traces, technological marks, and micro-topographical modifications.

Optical shadow effect modes afford the analyst considerable flexibility in optimising contrast for the specific surface characteristics of each artefact under examination. The capacity to toggle between illumination configurations in real time, without necessitating physical reconfiguration of the instrument, represents a substantial operational advantage over traditional optical microscopy.

One of the most transformative capabilities of the VHX-X1 in an archaeological context is its integrated three-dimensional surface reconstruction functionality. By acquiring a z-stack of images across a defined focal depth range and computationally combining these into a single composite representation, the instrument generates a fully focused, three-dimensional model of the examined surface.

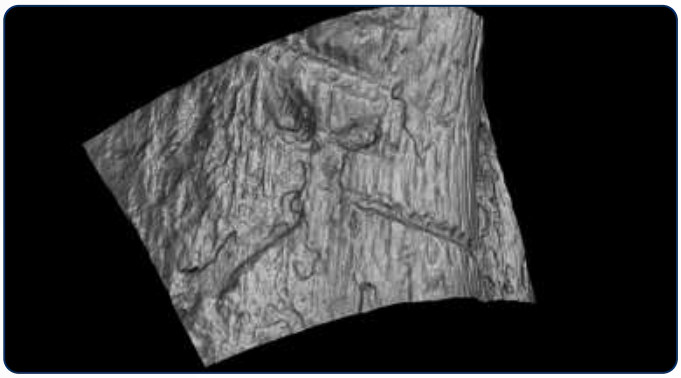
This model may be rendered as a photorealistic composite image, a depth map, or a colour-coded topographical profile. The 3D Height/Color mapping function translates micro-topographic elevation data into a chromatic scale, in which different colours correspond to discrete height values across the examined surface.

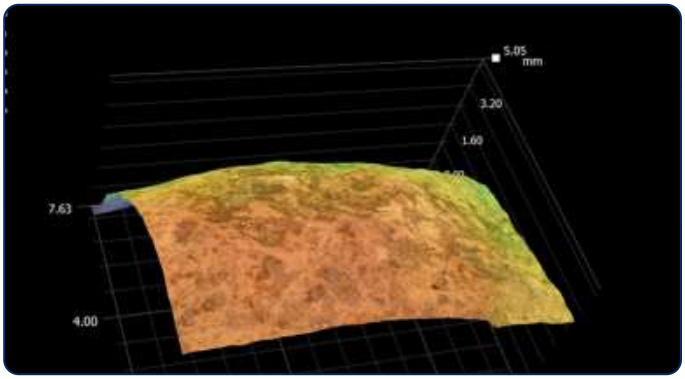
This approach generates a colour-coded topographical profile that enables precise, qualitative assessment of volumetric surface modifications. Features such as the depth and cross-sectional morphology of incised grooves, the profile of anthropogenic perforations, the extent of abrasive usewear facets, and the three-dimensional geometry of fracture surfaces may all be characterised with a level of precision that conventional two-dimensional photography cannot provide.

From the traceological analysis of lithic, bone, and metal implements, through the characterisation of anthropogenic perforations, ceramic surface treatments, zooarchaeological bone modifications, and pigment applications, to the documentation of numismatic and small find detail, the VHX-X1 microscope has demonstrated its utility as a transformative instrument in archaeological science. Its capacity for non-destructive, high-resolution, multi-modal surface documentation, combined with the generation of permanent three-dimensional digital records.









A NANOMATERIALS AND NANOTECHNOLOGIES

7 METAL AND DIELECTRIC LAYERS DEPOSITION BY SPUTTERING



This equipment is a physical vapor deposition (PVD) method for creating thin films, using sputtering depositions. The device contain two sputtering sources or magnetrons, which can be loaded with the material of the desired coating composition; the sputtering is achieved with high voltage DC or RF argon plasma, but other gases can be used to create coatings via the reactive sputtering method. This equipment is configured for argon and nitrogen. Up to 6 materials sequentially or 2 materials simultaneously on substrates up to 250 mm dia may be submitted.

Depositions chambers connected to a vacuum system have the following features:

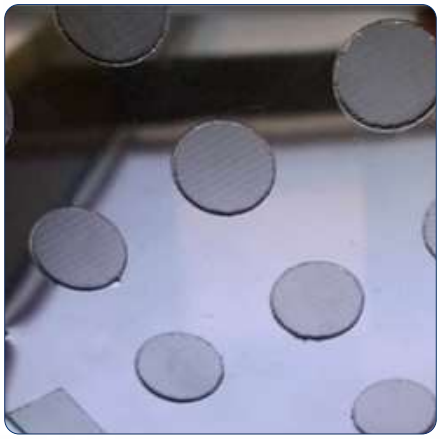
- ✔ **stainless Steel Chamber 454 mm height × 454 mm width × 454 mm length;**
- ✔ **working mode, in vacuum and high vacuum (< 5 × 10^{-8} Torr);**
- ✔ **2 electron gun magnetron: Ø2".**

Depositions chambers connected to a vacuum system have the following features:

- ✔ **Stainless steel chamber: 454 mm (H) × 454 mm (W) × 454 mm (L);**
- ✔ **Operating modes: vacuum and high vacuum (< 5 × 10^{-8} Torr);**
- ✔ **Two electron-gun magnetrons, Ø 2 in. (diameter 2 inches).**

Comparison of Typical Thin Film Deposition Technology

Process	Material	Uniformity	Impurity	Grain size	Film Density	Deposition rate	Substrate temperature	Directional	Cost
Thermal evaporation	Metal or low melting-point materials	Poor	High	10–100 nm	Poor	1–20 A/s	50-100°C	Yes	Very low
E-beam evaporation	Both metal and dielectrics	Poor	Low	10–100 nm	Poor	10–100 A/s	50-100°C	Yes	High
Sputtering	Both metal and dielectrics	Very good	Low	~10 nm	Good	Metal: ~ 100 A/s Dielectric: ~ 1–10 A/s	~ 200°C	Some degree	High
PECVD	Mainly dielectrics	Good	Very low	10 – 100 nm	Good	10–100 A/s	200–300°C	Some degree	Very High
LPCVD	Mainly dielectrics	Very Good	Very low	10 – 100 nm	Excellent	10–100 A/s	600–1200°C	Isotropic	Very high



APPLICATIONS:
Thin films and multilayers of:

- ✔ hin-film solar cells;
- ✔ semiconductors;
- ✔ metals conductive/ rezistive metal /insulator;
- ✔ magnetic multilayers with giant magnetoresistance (GMR, TMR);
- ✔ sensors from thin layers;
- ✔ transparent electrical conductors (eg. ITO);
- ✔ applications of optical communications (e.g. „pump lasers");
- ✔ coatings for lenses (reflective, antireflective, color);
- ✔ precious metals (with maximum use of the cathode);
- ✔ coatings for surgical/medical implants .

COMPARISON WITH OTHER DEPOSITION METHODS

An important advantage of sputter deposition is that even materials with very high melting points are easily sputtered while evaporation of these materials in a resistance evaporator or Knudsen cell is problematic or impossible. Sputter deposited films have a composition close to that of the source material. The difference is due to different elements spreading differently because of their different mass (light elements are deflected more easily by the gas) but this difference is constant. Sputtered films typically have a better adhesion on the substrate than evaporated films. A target contains a large amount of material and is maintenance free making the technique suited for ultrahigh vacuum applications. Sputtering sources contain no hot parts (to avoid heating they are typically water cooled) and are compatible with reactive gases such as oxygen. Sputtering can be performed top-down while evaporation must be performed bottom-up.

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A NANOMATERIALS AND NANOTECHNOLOGIES

8 REACTIVE ION ETCHING (RIE)



The RF Nano-PC installation has a unitary construction that ensure all equipment functions, in compliance with protection from corrosive gases, Faraday cage for industrial frequency generator, protective coating and gas filtration. The equipment is equipped with 2-channel gas: resistant to corrosive gas type CF_4, SF_6 (from stainless steel); channels controlled by MFC (Mass Flow Controllers) from the computer. The equipment can be used for etching with gases such as: O_2, N_2, Ar, CF_4, SF_6, air, or any combination of these gases.

The basic control parameters are: base pressure; pumping time; flow through the MFC; radio frequency power generator; operating time; the time ventilation; temperature; alarm in case of opening the door during the process; display errors.

REACTION CHAMBER

- **stainless steel tanks;**
- **chamber volume 24 liters;**
- **aluminium door with quartz window;**
- **special electrode RIE (Reactive Ion Etching) with shower included.**

RADIOFREQUENCY GENERATOR:

- **fixed frequency 13.56 MHz;**
- **manually adjustable power between 0 and 300 W (with accuracy of ± 1 W);**
- **PC for automatic adjustment of power;**
- **display of power generated and frequency of work;**
- **protection against opening the door during the process.**

MAXIMUM SAMPLE SIZE IS 200 x 400 x 200 mm

APPLICATIONS:

- **cleaning of surfaces before processing them;**
- **activation of surfaces;**
- **corrosion of surfaces;**
- **surface treatment.**

AREAS OF APPLICATION MAY INCLUDE RESEARCH INTO:

REM; TEM; archeology; electronics and microelectronics; elastomers; medical technology; semiconductors; sensors; etc.

A NANOMATERIALS AND NANOTECHNOLOGIES

9 COMPLEX SYSTEM FOR MICROENCAPSULATION

Model: VAR J1

Description:

In most applications involving immobilisation of living cells or other biological materials the bead size is needed to be small (<1 mm) and carefully controlled. The reason for this is mostly because of diffusion limitation of nutrients within the hydrogel beads.

An easy way for production of small alginate beads in a controllable manner is the use of a coaxial bead generator. The basic principle of the instrument is the use of a coaxial air stream to pull droplets from a needle tip into the gelling bath.

The Nisco VARJ1 is designed for production of smaller quantities of spherical alginate beads ranging in size down to around 500 µm.



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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

10 X-RAY DIFRACTOMETER (XRD)



TECHNICAL CHARACTERISTICS:

- multipurpose and multifunctional X-ray diffraction (XRD) system, incorporating a vertical goniometer θ/θ (radius: 285 mm), geometry G/9, cross beam optics (CBO) technology for permanently mounted, permanently aligned;
- full automated alignment under computer control;
- X-ray tube – Cu anode (2 kW); NaI detector, limited >700000 cps;
- symmetrical and asymmetrical geometries (optical configuration user-selectable): focused high resolution Bragg Brentano geometry, high resolution parallel beam geometry for X-ray reflectivity (XRR) and grazing incidence X-ray diffraction (GIXRD), transmission and grazing incidence SAXS geometry (Small Angle X-Ray Scattering), micro-area X-ray diffraction;
- scanning axis: Ts (tube height), Zs (slit height), θD, θS;
- flexible optical system: slits with scanning axis Ts: 0.001 mm, θD, θS: 0.00010; minimum step on coupled θD/θS: 0.0002 and independent θD/θS: 0.0001–60.0.

APPLICATIONS:

- **phase identification, quantitative analysis, crystallographic structure determination, crystal lattice type, crystallinity percentage, crystal size/strain analysis, lattice parameters, Rietveld refining;**
- **microstructure – preferential orientation in pole–figure analysis, residual stress ($\sin^2\psi$, bi-axial);**
- **thin films applications (phase identification, orientation/structure, strain/stress, thickness/profile depth on film, interface roughness, density);**
- **SAXS applications (molecular structure and orientation of polymeric materials);**
- **nanoparticle size distribution in suspensions;**
- **particle size distribution in bulk type nanomaterials;**
- **molecular morphology and orientation in nanocomposites;**
- **high resolution X-ray reflectivity, mapping in 3D reciprocal space.**

SAMPLE **powders, nanopowders, solid bulk materials, thin films.**

DOMAINS: environment, nanotechnology, food industry, agriculture, cosmetics, metallurgy, chemical and petrochemical industry, polimers, semiconductor manufacturing, photovoltaic systems, materials, archeology, etc.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

11 WAVELENGTH DISPERSIVE X-RAY FLUORESCENCE SPECTROMETER (WDXRF)



TECHNICAL CHARACTERISTICS:

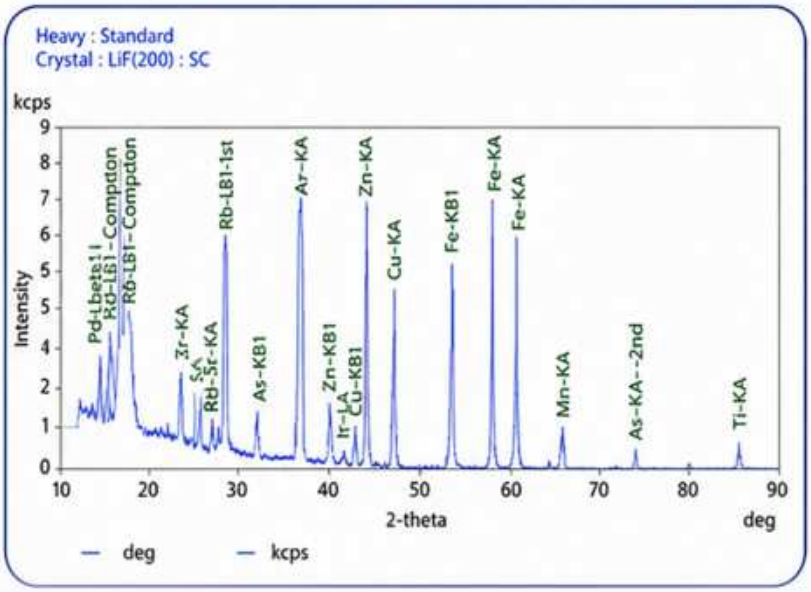
- ✓ sequential wavelength dispersive X-ray fluorescence benchtop spectrometer for elemental analysis;
- ✓ PC controlled system, equipped with automatic sampler, 12 places (solid and liquid samples accessorized) in vacuum, air or helium atmosphere;
- ✓ system equipped with 3 position crystal changer: LiF (200) for heavy elements (Ti–U), PET and RX25 for light elements (O–Mg and Al–Sc);
- ✓ X-ray tube, 50 kV, 4 mA, 200 W, Pd anode;
- ✓ Detection limit: 1 ppm–10 ppb; Precision < 0.1 – 0.5%.

APPLICATIONS:

qualitative and quantitative elemental analysis (between ^{8}O and ^{92}U) in solid samples (powders, alloys, thin films) and liquid samples, in vacuum, air, or helium atmosphere.

DOMAINS:

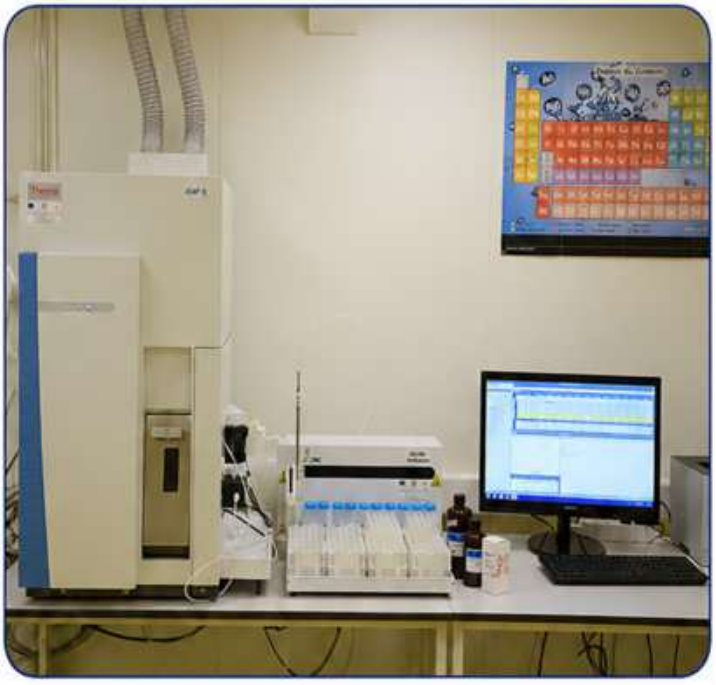
environment (waters/drinking, waste, soil), food industry and agriculture, pharmaceutical and cosmetic industry, geology, metallurgy, analysis of materials, semi-conductors, polymers, electronics, energy, medicine, petroleum industry, archeology, etc.



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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

12 INDUCTIVELY COUPLED PLASMA MASS SPECTROMETER (ICP-MS)



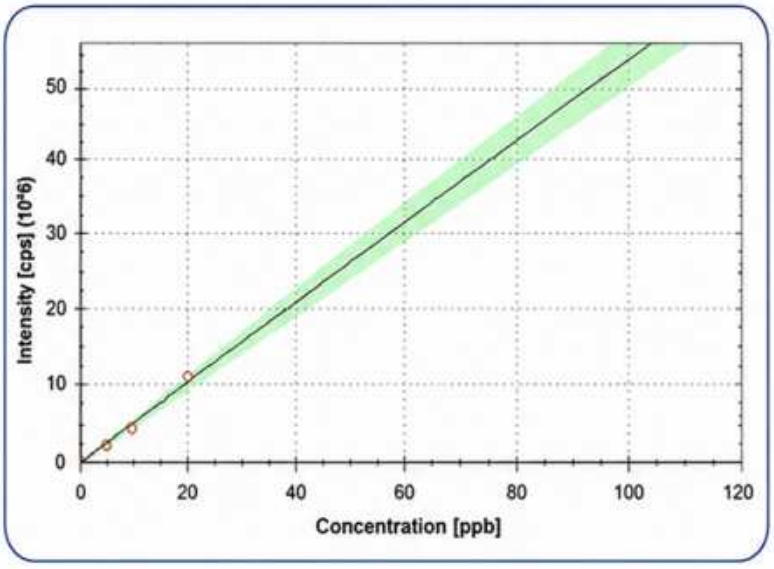
TECHNICAL CHARACTERISTICS:

- ✓ complete system with advanced technology enhancing high-performance analysis combined with total reliability and ultra-flexibility;
- ✓ innovative RAPID (Right Angle Positive Ion Deflection) lens technology (90° ion optics) for efficient separation of ions and neutrals;
- ✓ innovative interface with skimmer cone featuring unique, user-replaceable inserts mounted behind the cone tip to control memory effects;
- ✓ high-performance quadrupole analyzer pumped by a novel split-flow turbo pump backed by a single rotary pump;
- ✓ new simultaneous analog/PC detector with real-time multi-channel analyzer electronics, providing > 9 orders of dynamic range, suitable for both steady-state and transient signal analysis;
- ✓ robust RF generator with fast dynamic frequency impedance matching for high plasma stability.

Detection limits: ^{8}Be < 0.5 ng/L (ppt); ^{115}In < 0.1 ng/L (ppt); ^{209}Bi < 0.1 ng/L (ppt); oxides CeO/Ce < 2%.

Stability: short term (%RSD): < 2% (10 min); long term (%RSD): < 3% (2 h).

Isotopes precision ratio: ^{107}Ag / ^{109}Ag < 0.1 (%RSD).



APPLICATIONS:

quantitative and qualitative elemental analysis (in the range ^{7}Li–^{238}U) in homogeneous liquid samples.

DOMAINS:

environment (drinking water, wastewater, soil), food industry and agriculture, pharmaceutical and cosmetic industry, geology, energy, medicine, cement industry, metallurgy, oil industry, etc.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

13 FOURIER TRANSFORM INFRARED SPECTROMETER COUPLED WITH HIGH RESOLUTION INFRARED MICROSCOPE



FT-IR spectroscopy system for advanced research consists of: FT-IR spectrometer Vertex 80v and high-resolution microscope Hyperion 2000. The system is designed for advanced research activities in various fields: physics of materials, environmental studies, studies of inorganic, organic, macromolecular and pharmacology, molecular and cellular biology, research in ceramics and semiconductor, composites and nanomaterials research, food analysis, study of documents and art objects and other fields.

Vertex 80v spectrometer is a rugged equipment which eliminates atmospheric moisture absorptions and provides peak sensitivity and stability, especially in the far IR spectral regions. The new automatic beamsplitter exchange (BMS-c) unit allows software controlled extension of the spectral range without break of the spectrometer vacuum.



Hyperion 2000 is used for highest sensitivity at the highest spatial resolution in FT-IR microscopy and chemical imaging. It is designed without compromises, to combine best performance for visible inspection and infrared spectral analysis of any sample.

	Vertex 80v	Hyperion 2000
Spectral range	350-8000 cm^{-1}	600-7500 cm^{-1}
Spectral resolution	0.2 cm^{-1}	Depends on the Vertex 80v
Accuracy	0.1% T	± 1 μm

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

14 UV VIS DOUBLE-FASCICLE SPECTROPHOTOMETER EVOLUTION 260 BIO – Thermo Scientific

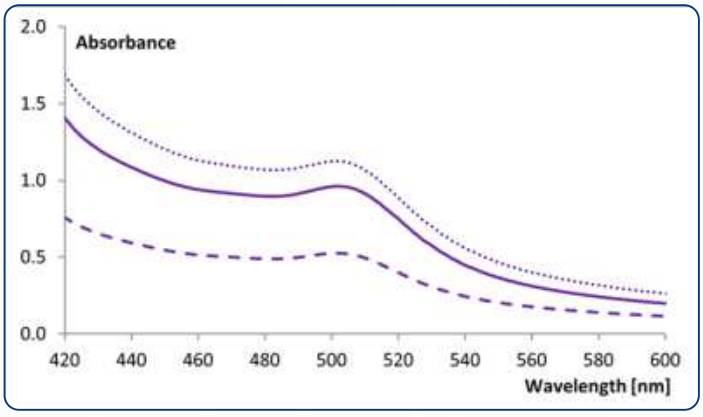


Thermo Scientific Evolution 260 BIO spectrophotometer offers performance, reliability and high quality results. It allows advanced research with the possibility of adapting to the rapid changes which take place in the life sciences. The instrument is controlled by software which contains methods for the following applications:

- ✓ environmental analysis (Al, BOD, Ca, Fe, Mo, N, P, Ag, S, alcohol, B, C, F, Pb, Ni, O, K, Na, COD, Au, Mg, O_3, Zn, Cd, Cu, I, Hg, phenol);
- ✓ cosmetic industry (including methods for color analysis);
- ✓ clinical chemistry and health;
- ✓ food analysis (including kinetic methods: ascorbic acid, formaldehyde, glycerin, alcohol, cholesterol, formic acid, glucose, sucrose, ammonia, hydrazine, etc.);
- ✓ materials analysis.

TECHNICAL DATA:

- ✓ **wavelength range: 190 to 1100 nm;**
- ✓ **wavelength accuracy: ± 0.8 nm;**
- ✓ **repeatability: ≤ 0.1 nm;**
- ✓ **photometric range: > 3.5 A.**



B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

15 PORTABLE RAMAN SPECTROMETER IR IN TWO LENGTHS XANTUS-2 – Rigaku

Portable dual wavelength Raman analyzer equipped with options of 785 and 1064 nm stabilized laser, providing high sensitivity. Xantus-2 utilizes integrated software combining open architecture with customizable, user-defined settings for optimized sampling parameters that result in comprehensive and actionable data analysis.

This device does not require special preparation of samples; liquid and solid samples can be analysed.



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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

16 HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY SYSTEM



Model: **1260 Infinity II LC System (with RI detector, diode array detector, and FLD spectra)**

Producer: **Agilent**

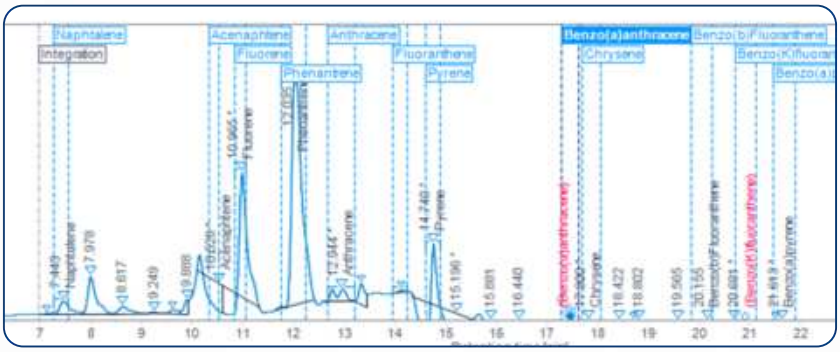
Description:

The 1260 Infinity II LC System is a robust HPLC that offers the widest choice of modules for analytical HPLC and entry-level UHPLC, delivering the performance, reliability, and robustness you need for the highest confidence in your daily results.

The Agilent 1260 Infinity II LC System is part of the Agilent InfinityLab family, every component is designed to work together. Secondary detectors can supplement or replace the standard diode array detector to detect the analytes.

It allows connecting modules from another Agilent HPLC series to achieve the desired analysis by HPLC.

The Flex Bench system enables easy module exchanges and offers an ergonomic option to stack MS systems with the HPLC system.



B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

17 ATOMIC ABSORPTION SPECTROMETER (AAS)

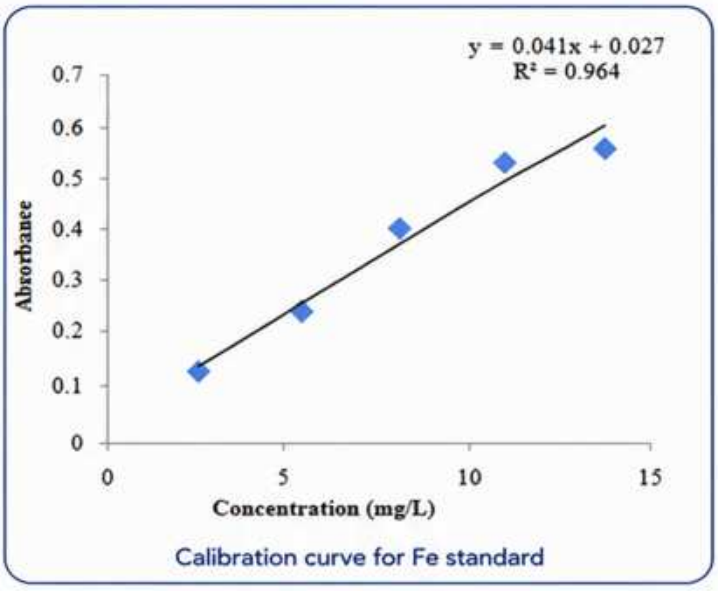


TECHNICAL CARACTERISTICS:

- ✓ complete system, PC controlled, equipped with 6 lamps turret, with automatic alignment optimized Czerny-Turner monocromator, wavelength and slit automatic selection wavelength range: 185 - 900 nm;
- ✓ slit automatic selection: 0.2; 0.5; 0.8, 0.2 nm;
- ✓ source: hollow cathode lamps (of the metal to be determined), HCL, SHCL, D2HCL;
- ✓ detector – photomultiplier UV sensitive, extended spectral range;
- ✓ background correction for flame and graphite furnace techniques – high frequency Deuterium lamp (300Hz);
- ✓ compensation up to 3 Abs, enhanced signal-noise ratio;
- ✓ zeeman background correction for graphite furnace technique – bipolar magnetic field, transverse, 2-field and 3-field correction mode.

DISPLAY:

Absorbance (-0.01 up to 3.00);
Concentration (units selection: mg/L, µg/L, others) with 5 digits (0.0001 to 99.999);
Calibration curve up to 30 standards (linear, non-linear).



Calibration curve for Fe standard

APPLICATIONS:

Quantitative elemental analysis in liquid homogenous samples (after digestion and specific preparation); with present instrument configuration one can determine concentration of Pb, Ca, Mg, Cr, Fe, Zn, Na, Al, K, Ti, Ni, Cu, Ge, Se, Sr, Y, Zr, Ag, Cd, Mn, Au up to 1 ppm detection limit (flame technique), respectively 1 ppb (graphite furnace).

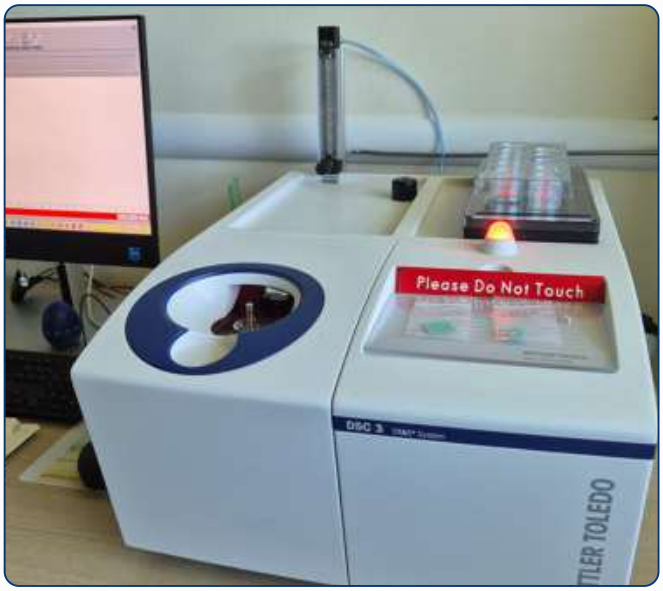
DOMAINS:

Environment (waters / drinking, waste, soil, etc.), food industry and agriculture, pharmaceutical and cosmetic industry, geology, metallurgy, analysis of materials, semi-conductors, polymers, electronics, energy, medicine, petroleum industry, etc.

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

18 THERMAL ANALYSIS SYSTEM DSC 3-STAR^e



The DSC 3 – Star^e System is a precision thermal analysis instrument based on Differential Scanning Calorimetry (DSC) with Advanced PC Control. It is designed to measure the heat flow associated with physical and chemical transitions in materials as a function of temperature or time. The system provides precise characterization of thermal events such as melting, crystallization, glass transition, curing reactions, and thermal stability, supporting a wide range of applications in research, development, and quality control. The system is equipped with the STAR
which offers functionalities for experiment control, data acquisition, powerful data evaluation, and flexible method development.

TECHNICAL CHARACTERISTICS



• Temperature range: ambient to 500°C (air cooling), −150°C to 500°C (with external cooling systems); temperature accuracy: ≤ ± 0.2 K; temperature precision: ≤ ± 0.02 K

• Heating rate: Adjustable within the range of 0.02 to 300 K/min; cooling rate: adjustable within the range of 0.02 to 50 K/min

• Calorimetric measurement range: ± 350 mW at 100°C; calorimetric resolution: 0.05 µW

• Cooling system interface: available connection to external cooling systems to enable measurements at sub-ambient temperatures, with automatic control

• Available interfaces connections for integration of: ultraviolet irradiation system (allowing monitoring of photo-induced effects as a function of time, radiation intensity, and temperature), optical system (digital image acquisition and processing)

• Measurement capabilities: testing, detecting, measuring, and characterizing of: phase transition temperatures (first-order and second-order), reaction and transition enthalpies; kinetic behavior of chemical reactions; degree of crystallinity and thermal behavior of polymers and other materials; crosslinking properties, stability, miscibility, and compatibility of materials such as polymer composites, rubbers, and thermosetting materials

STARE SOFTWARE CAPABILITIES

• full communication with the thermal analysis hardware system, providing capabilities for control and execution of thermal analysis experiments, as well as storage and evaluation of DSC curves;

• tools for creating and defining experimental methods, enable monitoring and display of calorimeter parameters, ensure real-time visualization of acquired data during measurements;

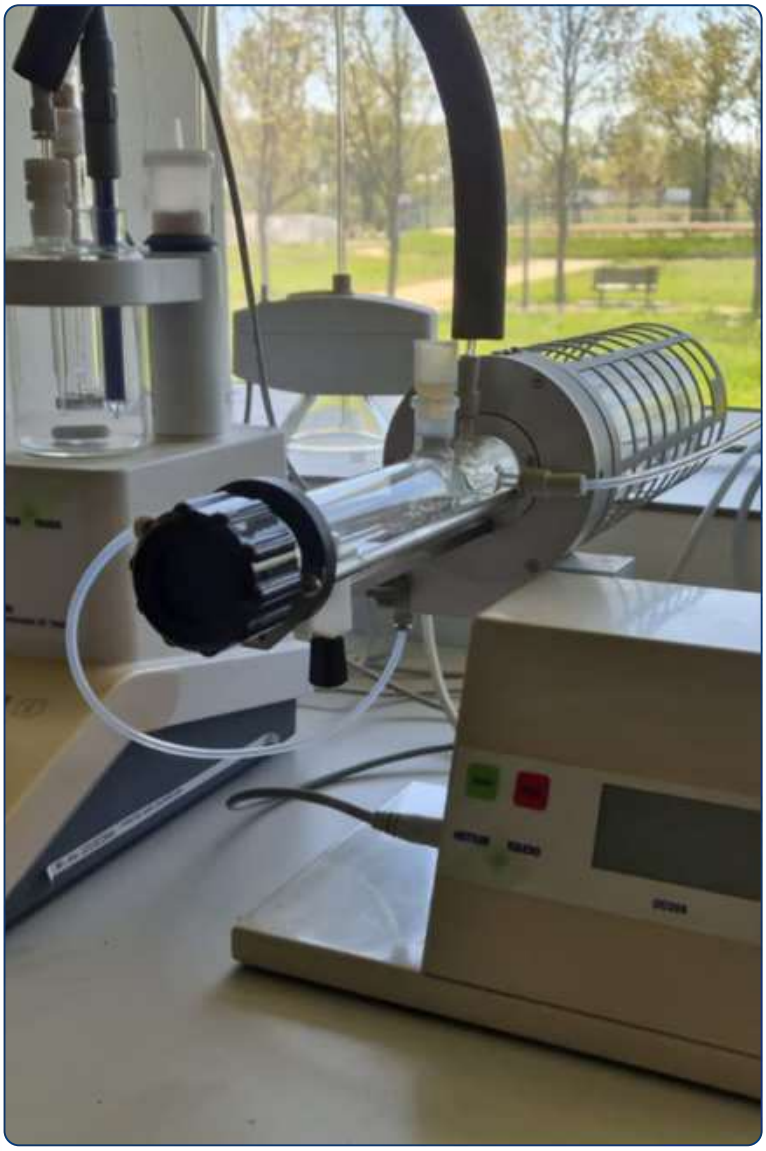
• capabilities for analysis and simulation of chemical reactions, including calculation of kinetic parameters; include functions for calculation of content, degree of crystallinity, conversion, enthalpy, and glass transition; include functions for specific heat capacity calculation;

• advanced data processing capabilities, including: background noise reduction, blank/reference correction, tabular and graphical data display, curve representation as a function of reference temperature, sample temperature, or time, database storage and management, including filtering by methods, experiments, evaluations, and curves;

• Import/export of data, methods, experiments, and files, thermogram evaluations, selection of evaluation limits; multiple measurements (repeated runs on the same crucible); manual evaluation of transformation onset temperature; automatic calculation of onset and end temperatures of transformations; peak temperature determination.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

19 KARL FISCHER COULOMETRIC TITRATOR



TECHNICAL CHARACTERISTICS:

- ✓ compact equipment with columetric cell without diaphragm, titration vessel, platinum electrode, automatic system for draining / solvent manager (ISO 10337 or equivalent compatible);
- ✓ sample weight (liquid or solid): 10 µg – 200 mg; colour displayed (selectable measurement unit);
- ✓ method creation and saving, through existing software (memory for operator, working parameters, sample data, etc.);
- ✓ Water content in samples, from 1 ppm to 5%, Resolution H_2O: 0.1 µg.

APPLICATIONS:

Water content determination from various samples (i.e. oils, fuels, ketones, etc).

DOMAINS:

Petroleum industry, cosmetics, pharmaceuticals, food industry, etc.

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

20 HALOGEN MOISTURE ANALYZER METTLER TOLEDO HS153 MODEL

TECHNICAL CHARACTERISTICS:

- ✓ equipment consisting of a balance and a halogen heating unit;
- ✓ the halogen unit provides a fast heating and a precise temperature control, shorter heating – cooling cycles can also be performed;
- ✓ sample weight is shown on the digital display color (selectable measure unit);
- ✓ correction factors can be used, through software setting;
- ✓ measurement range (resolution):

  Weight: 2 – 150 g (1 mg),

  Temperature:** 40°C - 230°C (1°C);
- ✓ moisture content – resolution 0,01% (sample weight min. 10 g), respectively 0.05% (sample weight min. 2 g)



APPLICATIONS:

moisture determination of solid samples, through differential weighing - before and after heating process.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

21 ELEMENTARY ANALYZER C, S and Cl SOLIDS ANALYSIS Multi EA 4000 - Analytik Jena

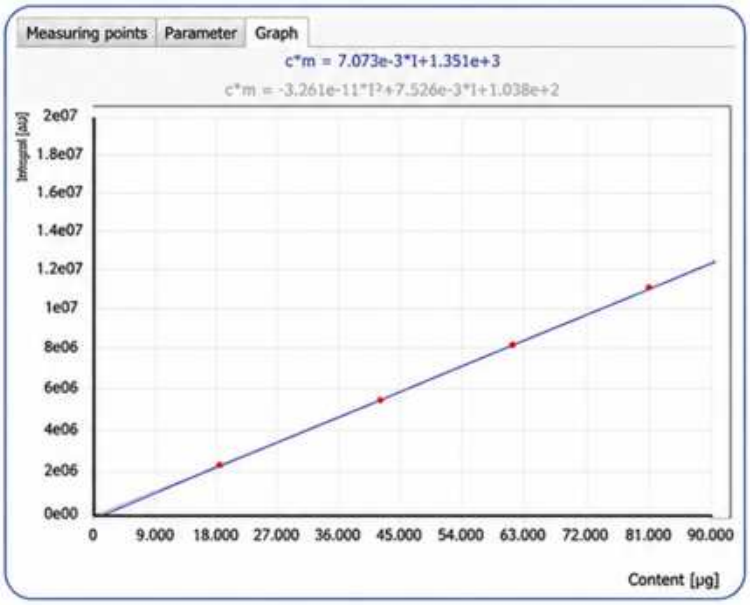


Multi EA 4000 is a device used for the determination of carbon (TC, TIC), sulfur (TS) and chlorine (TCl) of solid samples or viscous paste. The operating principle of the device is based on the high-temperature combustion (1000 - 1500°C) of samples in oxygen flow. The core of the device is the furnace which provide high temperature necessary for sample decomposition (pyrolysis and combustion oxidation).

DETERMINATION OF C AND S:

The gas generated from burning arrive on NDIR detector (Non-Dispersive Infrared), which following molecular absorption of CO_2 / SO_2 at specific wavelengths, transmits the signal to the recording system and data processing.

Software MultiWin plot the combustion curve of the sample. The area of the curve is directly proportional to the concentration of the element in the sample.



DETERMINATION OF Cl:

It is based on the coulorimetry principle: chloride ions react with electrolytically generated silver ions resulting silver chloride.

FIELDS OF APPLICATION:

- ✓ **waste management (determination of C and S in waste, of Cl in surrogate fuel);**
- ✓ **environmental monitoring (determination of C and S in soils, sediments, vegetables samples);**
- ✓ **energy industry (determination of C and S in carbon and residual ash);**
- ✓ **materials engineering (determination of C and S in building materials: cement, plaster, ceramics, glass, etc.).**

MEASURING RANGE:

- **C: 0-100%**
- **S: 0-20%**
- **Cl: 0-20%**

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

22 CALORIMETER - 6400 AUTOMATIC ISOPERIBOL CALORIMETER – Parr Instrument Company



Parr 6400 Calorimeter is used to determine the specific heat of the sample, relative to a standard sample heat. The burning is accomplished in metal pressure vessel and controlled atmosphere of oxygen - called "bomb". The energy released from the combustion is absorbed by the calorimeter and the result - temperature changes - is determined.

The 6400 Automatic Isoperibol Calorimeter represents the next evolutionary step in the Parr automated calorimeters. Inclusive and compact, the instrument incorporates a closed loop cooling subsystem into the calorimeter. This subsystem uses a thermoelectric cooler assembly attached directly to a one liter water tank which supplies cooling water to the calorimeter. An external nitrogen pressurized tank is used to supply rinse water to the calorimeter.

SAMPLES TYPES:

- ✓ **coal and coke, fuel oil, gasoline and kerosene, combustible wastes;**
- ✓ **foodstuffs and supplements for human nutrition, forage crops and supplements for animal nutrition;**
- ✓ **building materials;**
- ✓ **explosives, rocket fuels and related propellants.**

Samples can be: solids (compact, large particles, powders).



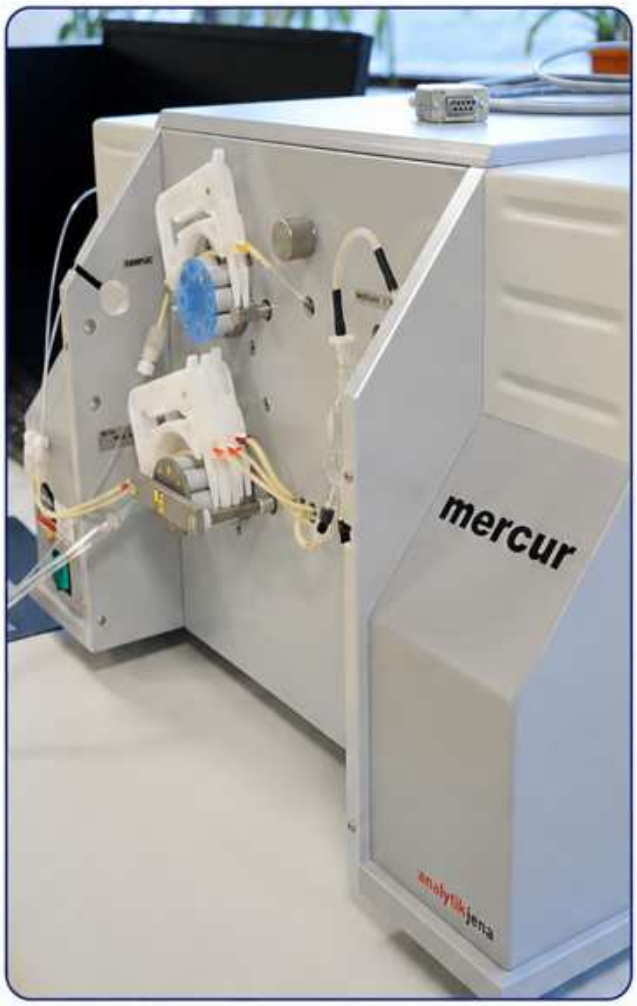
TEMPERATURE RESOLUTION:
0.0001°C

CALORIE SAMPLE RANGE:
5000 – 8000 cal.

PRINCIPLE:
The energy released from the combustion is absorbed by the calorimeter; the temperature change is measured isoperibolically.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

23 MERCURY ANALYZER MERCUR DUO – Analytik Jena



Mercur Duo is a device used for the determination of Hg by two methods: atomic absorption (AA) and atomic UV fluorescence (FA). Using these two methods the application range is extend from ng/L (ppt) to mg/L (ppb).

Determination of mercury in liquid samples is performed; the samples require prior mineralization using acid mixtures. Mercur Duo is mainly used in water and wastewater laboratories and for environmental analysis.

THE ANALYSIS PRINCIPLE:

ATOMIC FLUORESCENCE:
detection of the mercury fluorescence radiation at the 90° angle.

ATOMIC ABSORPTION:
detection of absorption of lamp radiation energy in the sample.

Mercury is released using stannous II chloride ($SnCl_2$) as reducing medium and transported in atomic form.
The released mercury can be measured directly without being enriched.

SAMPLES:
Determination of mercury in liquid samples is performed; the samples require prior mineralization using acid mixtures.

APPLICATIONS:
Water and wastewater laboratories and environmental analysis.

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

24 QUARTZ CRYSTAL MICROBALANCE

Quartz Crystal Microbalance (QCM) is a very sensitive sensor, capable of measuring mass changes in the spectrum of nanogram/cm^2 with a wide dynamic spectrum to 100 mg/cm^2. QCM is a rapid method for analysis, but an expensive at the same time.



QCM CAN BE USED AS:

- ✓ **chemical and biochemical sensor;**
- ✓ **immunosensor;**
- ✓ **system auto-submission of monolayers (Self-Assembled monolayer - SAM).**

MEASUREMENTS REALIZED WITH QCM CAN BE CATEGORIZED AS FOLLOWS:

- ✓ **static;**
- ✓ **dynamic;**
- ✓ **electrochemical (E-QCM) with dissipation (QCM-D).**

Quartz crystal microbalance (QCM) is used either for precise nanoscale deposition of masses and as the chemical sensor with high selectivity for organic compounds deposited layers. Mass changes occur in all chemical processes in the preparation of materials in electrochemical processes in biotechnology, in thin films formation in natural environment, adsorption / desorption of proteins, cell adhesion, degradation of polymers and biofilm, bio-impurities and drug analysis.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

25 OXIDATION STABILITY TESTER PetroOxy – Anton Paar

PetroOxy has been developed as a testing device for the oxygen stability of commercially available fuels. The patented Rapid Small Scale Oxidation Test (RSSOT) provides a complete oxidation stability analysis of petroleum products, automatically in a very short test time.

The results include all volatile and non-volatile oxidation products, providing a comprehensive analysis of the sample.



SAMPLES TYPES:

- **fuels (gasoline, diesel, biodiesel, Fatty Acid Methyl Esters (FAME), blends);**
- **mineral oils;**
- **additives;**
- **insulating oils etc.**

RAPID TESTING
Automatic testing in very short time using the patented RSSOT method.

COMPREHENSIVE RESULTS
Includes all volatile and non-volatile oxidation products.

HIGH ACCURACY
Reliable and reproducible results for a wide range of petroleum products.

WIDE APPLICATION RANGE
Suitable for fuels, oils, additives and insulating oils.

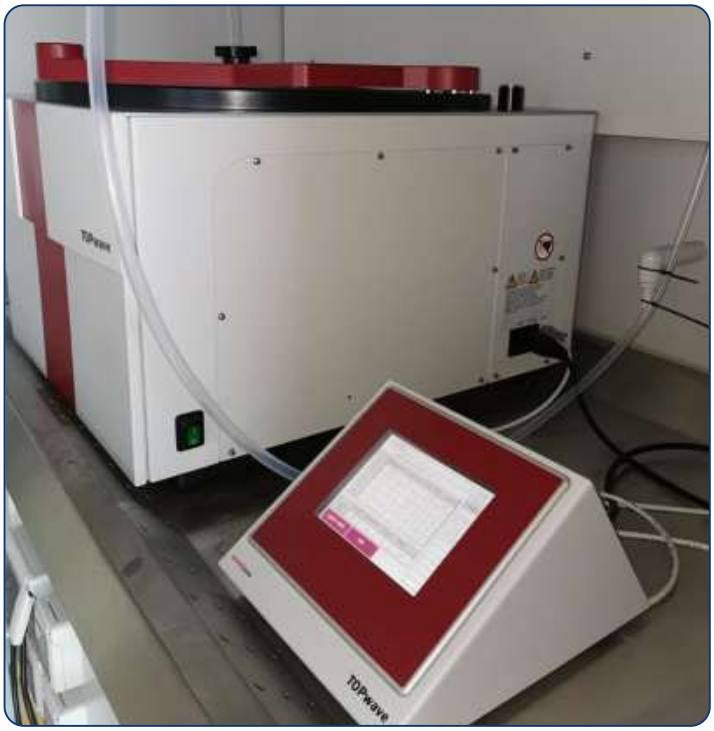
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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

26 DIGESTOR TOP WAVE

The system works with an innovative concept of sensors. Individual samples temperatures and internal pressures are measured and displayed individually and in real time.

Do not use immersion sensors or mechanical sensors - measuring system uses optical principles. There is no sensor installed, connected, cleaned or replaced - handling is thus simplified and consumables removed.



THE SYSTEM PROVIDES:

- **pressure microwave assisted digestion;**
- **a safe operation due SCS;**
- **smart design for safe operation;**
- **large number of samples;**
- **data available for digestion of any evidence;**
- **intuitive operation;**
- **minimum number of supplies.**

TOP wave is equipped with a touch-sensitive controller for controlling reactions and manipulating data. The algorithm monitors all parameters and adjusts the microwave power accordingly.
There are a number of pre-installed applications, a list of favorite applications containing 12 programs frequently used. You can store about an infinite number of new applications.
The software is intuitive, enabling remote operation via network connection and includes 6 languages. An internal memory can be used to store data that can then be exported via the USB jack.

REAL-TIME MEASUREMENT
Individual temperature and pressure monitoring for each sample.

OPTICAL SENSOR TECHNOLOGY
No immersion or mechanical sensors – no maintenance, no replacement.

SAFE & RELIABLE
SCS
(Safety Control System) ensures maximum safety during digestion.

HIGH THROUGHPUT
Large number of samples processed simultaneously.

INTUITIVE CONTROL
Touch-sensitive controller with pre-installed programs and flexible storage of new methods.

DATA MANAGEMENT
Internal memory and USB export for secure data storage and easy transfer.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

27 VISCOMETER PREMIUM – Fungilab

The software compatible with Windows allows the following data displayed: Selected speed rpm spindle selected SP, dynamic viscosity reading cP (mPa·s) or cSt kinematics, percentage of full scale %, °C or °F temperature probe (optional), the rate shear (coaxial rod) SR (s^{-1}), shear (coaxial rod) SS (N/m^2), density (inserted by the user) g/cm^3, status of the program step by step, analysis and visual features (flow curves).



KEY FEATURES

- Self-test function with acoustic alarm
- AUTO-RANGE function, with accuracy of ± 1 % of full scale
- Viscosity measurement range 0.1 to less than 10,000 CP
- High precision and repeatability
- Spindle made of stainless steel AISI 316
- 10 working memories
- Analysis and visual features (flow curves)
- Programmable multi-step ramp

DATA DISPLAYED

- Selected speed (rpm)
- Spindle selected (SP)
- Dynamic viscosity (cP) (mPa·s)
- Kinematic viscosity (cSt)
- Percentage of full scale (%)
- Temperature probe (optional) (°C or °F)
- Rate shear (coaxial rod) SR (s^{-1})
- Shear (coaxial rod) SS (N/m^2)
- Density (inserted by user) (g/cm^3)
- Program status (step by step) Analysis & visual features (flow curves)

PROGRAMMING FEATURES

For torsional timeout 10 working memories, programmable multi-step ramp.

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

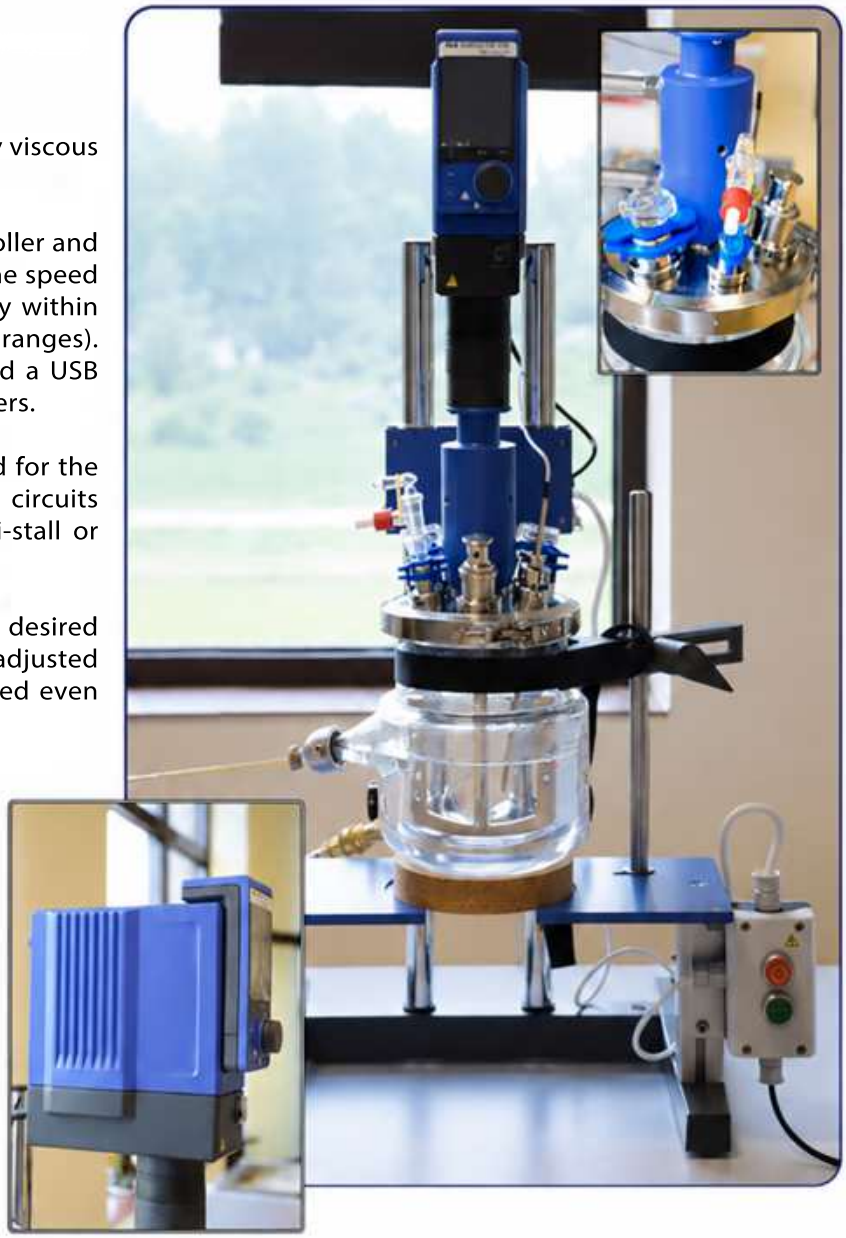
28 CHEMICAL REACTOR

Extremely powerful laboratory stirrer for highly viscous applications for quantities up to 100 L (H_2O).

It is designed with a removable wireless controller and a digital TFT display. It automatically adjusts the speed through microprocessor controlled technology within the speed range of 0/4 - 530 rpm (two speed ranges). The stirrer comes equipped with a RS 232 and a USB interface to control and document all parameters.

An integrated torque trend display is provided for the measurement of viscosity changes. Safety circuits installed ensures automatic cut-off in an anti-stall or overload conditions.

Continuous comparison of shaft speed to desired speed is maintained and variations are adjusted automatically. This guarantees a constant speed even with changes in viscosities of the sample.



MULTILINGUAL TFT DISPLAY:

- ✓ programmable functions;
- ✓ integrated temperature measurement;
- ✓ interval operation;
- ✓ timer function;
- ✓ adjustable safety circuit;
- ✓ locked function;
- ✓ infinitely adjustable speed;
- ✓ overload protection;
- ✓ short-term overload operation;
- ✓ slim casing;
- ✓ quiet operation;
- ✓ error code display.

POWERFUL PERFORMANCE
Designed for highly viscous applications up to 100 L (H_2O).

MICROPROCESSOR CONTROL
Automatic speed adjustment in the range 0/4 - 530 rpm (two speed ranges).

TORQUE TREND DISPLAY
Integrated torque monitoring for viscosity change measurement.

SAFETY FIRST
Anti-stall and overload protection with automatic cut-off.

DATA INTERFACES
RS 232 and USB interface for control and documentation of all parameters.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

29 FAT EXTRACTOR N 6 – Selecta

A Sohexlet Extractor has three main sections: A percolator (boiler and reflux) which circulates the solvent, a thimble (usually made of thick filter paper) which retains the solid to be laved, and a siphon mechanism, which periodically empties the thimble.
The solvent is heated to reflux. The solvent vapour travels up a distillation arm, and floods into the chamber housing the thimble of solid. The condenser ensures that any solvent vapour cools, and drips back down into the chamber housing the solid material.
The chamber containing the solid material slowly fills with warm solvent. Some of the desired compound dissolves in the warm solvent. When the Soxhlet chamber is almost full, the chamber is emptied by the siphon. The solvent is returned to the distillation flask. The thimble ensures that the rapid motion of the solvent does not transport any solid material to the still pot. This cycle may be allowed to repeat many times, over hours or days.



KEY FEATURES

- Suitable for fat and oil extraction
- Each position operates independently
- Made of high quality borosilicate glass
- Digital control with timer and temperature setting
- Uniform heating for accurate and reproducible results
- Easy to use and maintain
- Safe operation with efficient solvent recovery
- Ideal for quality control and analytical laboratories.

TECHNICAL SPECIFICATIONS

Number of positions	6
Temperature range	Ambient – 300°C
Timer	1 – 999 min
Solvent capacity (per position)	~ 100 mL
Power supply	230 V / 50–60 Hz
Construction	Stainless steel body with glass components

SOXHLET PRINCIPLE
Efficient and continuous extraction for accurate and reliable results.

PRECISE TEMPERATURE CONTROL
Uniform heating ensures optimal extraction efficiency.

SAFE & RELIABLE
Solvent recovery system and independent operation for maximum

TIME SAVING
Automated timer and independent positions increase productivity.

HIGH QUALITY MATERIALS
Borosilicate glass and stainless steel for excellent chemical resistance.

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

30 BERGHOF DIGESTOR MWS2

The instrument uses the microwave pressure digestion system, which considerably reduces duration of sample preparation (organic and inorganic matrixes) with safety operation. Suitable for samples derived from areas such as the environment, agriculture, nutrition, animal feed, geochemistry, petro-chemistry, metallurgy, human biology and pharmacy, others.



CHARACTERISTICS:

- **Compact stainless-steel oven with a capacity of 27 L.**
- **Interior temperature of the sample vessels (8 pcs) is determined with a contact-free IR thermometer, thus absolutely contamination-free temperature determination being insured.**
- **Closeable rotors with collecting vessel ensures top level safety and long service life.**
- **Simple retrofitting of an evaporation/concentration unit because of integrated suction feature.**
- **The integrated control enables the system to be operated after charging with samples.**

FAST & EFFICIENT
Microwave pressure digestion significantly reduces sample preparation time.

SAFE OPERATION
Advanced pressure and temperature control ensures maximum safety for the user and samples.

ACCURATE TEMPERATURE MEASUREMENT
Contact-free IR thermometer provides contamination-free and precise temperature monitoring.

WIDE APPLICATION RANGE
Suitable for environmental, agricultural, geochemical, biological, metallurgical and pharmaceutical samples.

FLEXIBLE & UPGRADEABLE
Integrated suction feature allows easy retrofitting of evaporation/concentration units.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

31 MULTIMETER – MULTI 9430

DIGITAL PRECISION METER FOR:

- pH — pH (0...14)
- Conductivity (0.00 µS/cm ... 2000 mS/cm)
- O_2 — Dissolved oxygen measurements (0.00 ... 19.99 mg/L)
- 3 dedicated electrodes and selectable resolution (0.001 / 0.01 / 0.1)



FUNCTIONS:

- Proven calibration procedures (max. 5 points)
- Automatic stability control
- Automatic sensor recognition
- Selectable measurement units
- Automatic temperature control
- Continuous measurement control

ACCURATE & RELIABLE
High precision measurements for pH, conductivity and dissolved oxygen.

3-IN-1 MEASUREMENT
One instrument for multiple parameters with dedicated electrodes.

EASY CALIBRATION
Up to 5-point calibration ensures accuracy and reproducibility.

AUTOMATIC CONTROL
Built-in functions for stability, temperature compensation and sensor management.

CLEAR DISPLAY
Large color display for easy reading of all measurements.

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B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

32 Electrochemical System Autolab 302N - PGSTAT302N





TECHNICAL DESCRIPTION

The PGSTAT302N is a high-performance potentiostat/galvanostat designed for advanced electrochemical measurements, including electrochemical impedance spectroscopy (EIS). The system combines high current capability with wide bandwidth and precise control, making it suitable for research and laboratory applications.

HARDWARE TECHNICAL CHARACTERISTICS:

Instrument type	**Modular potentiostat/galvanostat system**
Compliance voltage	**± 30 V**
Maximum current	**± 2 A (extendable up to 20 A)**
Current resolution	**0.0003 % of current range (down to 30 fA at low ranges)**
Current ranges	**9 ranges (from 10 nA to 1 A)**
Potential range	**–10 V to +10 V**
Potential resolution	**0.3 µV (gain 1000)**
Accuracy	**Potential: ± 0.2 % ± 2 mV Current: ± 0.2 % of current range**
Bandwidth	**up to 1 MHZ**
Input impedance	**1 TΩ**

FRA32M Module – electrochemical impedance spectroscopy (EIS)

- Frequency range: 10 µHz to 32 MHz (limited to 1 MHz with PGSTAT302N)
- Measurement modes: Potentiostatic and galvanostatic EIS
- Electro-hydrodynamic impedance measurements
- Photo-modulated impedance spectroscopy
- External signal modulation (e.g., rotating electrode speed, light frequency)
- Integrated fitting and simulation tools for impedance analysis.

SOFTWARE CAPABILITIES (NOVA 2.x):

Full control	Full control of potentiostat/galvanostat and FRA module via USB interface
Method editor	Powerful and flexible editor for creating custom electrochemical methods
Data acquisition	Real-time monitoring and visualization of measurement data
Data analysis	Advanced tools for processing, interpretation, and visualization of electrochemical data
Impedance analysis	Integrated fitting and simulation tools for EIS data
Visualization	Clear graphical representation of experimental data
Operating system	Compatible with Windows 10 Pro operating system

HIGH PERFORMANCE
High current capability (± 2 A) and wide bandwidth (up to 1 MHz) for advanced electrochemical measurements.

PRECISE & ACCURATE
High resolution and accuracy ensure reliable and reproducible results.

MODULAR & EXPANDABLE
Extendable current up to 20 A and compatible with a wide range of Autolab modules.

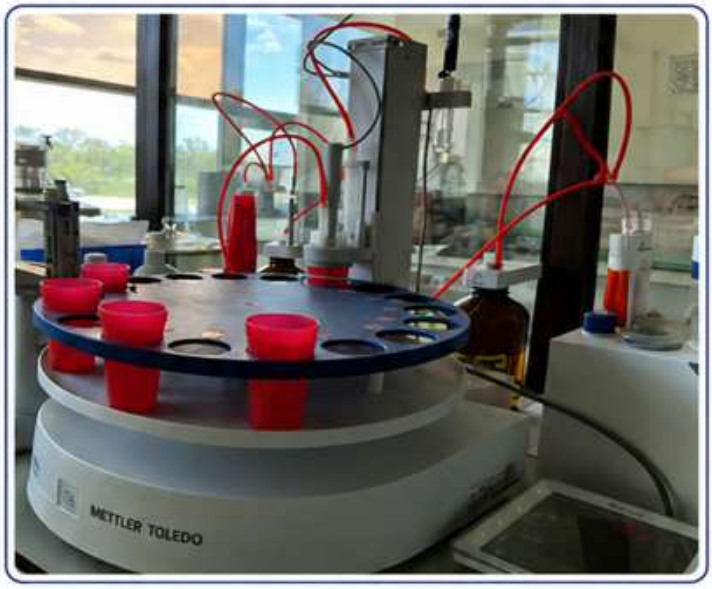
ADVANCED EIS CAPABILITIES
FRA32M module with frequency range up to 32 MHz (limited to 1 MHz with PGSTAT302N).

USER-FRIENDLY SOFTWARE
NOVA 2.x offers intuitive control, real-time monitoring, and advanced analysis tools.

B PHYSICAL AND STRUCTURAL CHARACTERISATION OF MATERIALS

33 Automatic Titration System Excellence T5 with InMotion Autosampler





The Titrator Excellence T5 is a modular analytical instrument designed for automatic titration, supporting a wide range of applications including potentiometric titration and Karl Fischer analysis. The system enables accurate and reproducible determination of chemical parameters in liquid and solid samples.

The instrument integrates a touchscreen terminal with intuitive operation, advanced data management, and flexible configuration, making it suitable for routine analysis, research, and quality control environments.

TECHNICAL CHARACTERISTICS

T5 EXCELLENCE TITRATOR

- **Modular platform, supporting various application requirements with potentiometric titration techniques, and multiple sensor types, enabling determination of parameters such as pH, acidity, alkalinity, redox potential, and ion-selective measurements.**
- **Measurement range (potentiometric): ±2000 mV**
  Resolution / error limit: 0.1 mV / 0.2 mV
- **Polarized sensor input: Range: 0–2000 mV / 0–200 µA**
  Resolution: 0.1 mV / 0.1 µA, Error limit: 2.0 mV / 0.2 µA
- **Temperature measurement (Pt1000): Range: –20 to 130°C**
  Resolution / error: 0.1°C / 0.2°C
- **Burette drive: Resolution: 0.5 µL (for 10 mL burette)**
  Error limit: 0.2% of burette volume
  Filling/dispensing time: ~20 s at maximum rate
- **Sensor inputs: 2 potentiometric, 1 polarized, 1 reference, 1 temperature (Pt1000)**
- **User interface: 7" color touchscreen (800 × 480 px)**
- **Additional features: Plug & Play automatic recognition of sensors and burettes, SmartSample™ RFID-based sample data handling, Security features (LevelSens, fingerprint reader)**

INMOTION™ FLEX AUTOSAMPLER

- **Modular, sample capacity up to 50 samples, supported beaker volumes: 5 mL, 80 mL, 100 mL, 180 mL and 250 mL**
- **Automation functions: sample changing, rinsing and conditioning sequences, parallel task execution (sample preparation during analysis)**
- **Modularity: expandable with pumps, stirrers, and liquid handling modules; vertical design for space-efficient integration.**

ACCURATE RESULTS
High precision measurements ensure reliable and reproducible chemical analysis.

AUTOMATED & EFFICIENT
Fully automated titration and sampling reduce manual work and increase throughput.

FLEXIBLE & MODULAR
Configurable system adapts to a wide range of methods and sample types.

SECURE & SMART
SmartSample™ RFID and security features ensure data integrity and traceability.

INTUITIVE OPERATION
Touchscreen interface and user-friendly software simplify daily operation.

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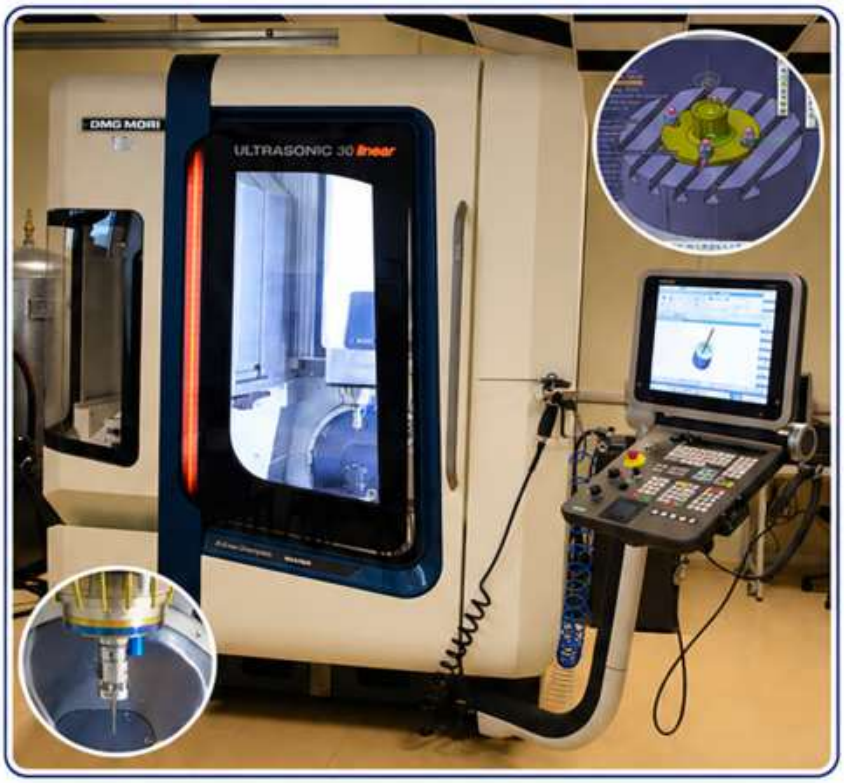
C PROTOTYPING AND TESTING PROCESS

34 5 AXES CNC ULTRASONIC 30 LINEAR VERTICAL MACHINING CENTER

The machining equipment ULTRASONIC 30 LINEAR on 5 axes is equipped with Sinumerik 840D solutionline numerical control and 3D control technology through the programming and simulating module ShopMill and it can machine complex geometry parts throughout various methods such as milling, drilling, boring, threading, for metal and non-metal materials. The machine is equipped with an ultrasound generator. When it's activated, the ultrasounds propagate to the tool holder, and by doing that to the normal rotatory movement of the tool is added a supplementary axial oscillation, of the milling tool (like a hammering of the part's surface), needed in the machining of the brittle materials. The quality of the machined surfaces is greater. The machining forces are lowered and so the finishing process of the surfaces is a better quality one. Depending on the material's properties, the surfaces can have a roughness under 0.1 µm.

The machine integrates on a single machine more procedures such as normal milling (HSC) ultrasound milling (HSK), which allows the machining of a big variety of materials. The equipment allows the machining of soft materials or rough ones (sapphire, ruby, titanium, CoCr for medical materials) and new composite materials (CFRP materials, GFRP or multilayer). Using diamond tools with a very defined geometry, you can machine SiC, Si_3N_4, Al_2O_3, ZrO_2 and other materials.

The maximum rotation in ultrasonic field and also in normal milling is 40,000 rot/min, the oscillating frequency in the ultrasonic domain is 20 kHz – 50 kHz; the maximum advance on the X, Y, Z axis is 320 mm, 300 mm and 280 mm, and the maximum admitted weight is 200 kg. The machine can be operated directly by the numerical control which is equipped with or by the mean of the postprocessor, connected to the computer, allowing in this way the machining of the 3D modelled parts in Catia or SolidWorks and for which it has been generated the CNC program using Catia Machining.



TECHNICAL CHARACTERISTICS

Numerical control	Siemens Sinumerik 840D solutionline
Programming / Simulation	ShopMill – 3D programming and simulation module
Axes configuration	5 axes simultaneous machining
Machining operations	Milling, drilling, boring, threading, HSC milling, ultrasonic milling (HSK)
Spindle maximum speed	40.000 rot/min (normal & ultrasonic milling)
Ultrasonic frequency	20 kHz – 50 kHz
Travel (X / Y / Z)	320 mm / 300 mm / 280 mm
Maximum workpiece weight	200 kg
Surface roughness	< 0.1 µm (depending on material)
Suitable materials	Sapphire, ruby, titanium, CoCr, CFRP, GFRP, multilayer composites, SiC, Si_3N_4, Al_2O_3, ZrO_2 and other advanced materials
Software integration	CATIA, SolidWorks and Catia Machining (via postprocessor)

HIGH PRECISION
Ultrasonic assistance and 5-axis technology ensure exceptional surface quality and dimensional accuracy.

WIDE MATERIAL RANGE
Machines hard, brittle, soft and composite materials with excellent results.

ULTRASONIC ASSISTANCE
Reduces machining forces and improves tool life while enabling sub-micron surface finishes.

FLEXIBLE & INTEGRATED
Combines HSC milling and ultrasonic milling on a single platform with 5-axis capability.

SMART & CONNECTED
Advanced CNC control and CAD/CAM integration for seamless workflow.

C PROTOTYPING AND TESTING PROCESS

35 CTX 310 ECOLINE CNC HORIZONTAL TURNING MACHINE



The CTX 310 ECOLINE turning machine is an horizontal one, with a maximum rotation diameter of 330 mm (260 mm above the transversal sledge) and turning machining possibilities of revolution parts, to which you can add the advantages of using rotative tools, fixed and moved by a turret with horizontal AX with 12 holders with the lathe is equipped, using the C axis CNC.

The lathe is equipped with Sinumerik 840D CNC solutionline, providing a 3D control technology, by module ShopTurn.

The maximum diameter the lathe can have is 200 mm; stroke of X axis (the diameter) is maximum 180 mm; stroke of Z axis (length) is maximum 400 mm; advance work on X and Z is up to 20 m/min; maximum speed is 5000 rev/min; positioning accuracy is 15 µm.

The machine can be controlled directly from the control with which it is equipped, or by using the postprocessor which connects with computer, allowing the pieces, modeled in 3D in Catia or SolidWorks, which were previously generated and simulated CNC program, using Catia Machining and dedicated postprocessor, developed specifically for this machine.

TECHNICAL CHARACTERISTICS	
Machine type	CNC horizontal turning machine
Maximum turning diameter	330 mm (260 mm above transversal sledge)
Maximum machining diameter	200 mm
X axis stroke (diameter)	max. 180 mm
Z axis stroke (length)	max. 400 mm
Rapid feed (X and Z)	up to 20 m/min
Maximum spindle speed	5000 rev/min
Number of tool holders	12 (turret with horizontal AX)
C axis	Yes (CNC)
Control system	Siemens Sinumerik 840D solutionline
Control technology	3D control technology via ShopTurn module
Positioning accuracy	15 µm

HIGH PRECISION
Excellent positioning accuracy (15 microns) ensures precise machining and high-quality finished parts.

VERSATILE MACHINING
Turning, drilling, boring, threading, and milling using fixed and driven tools with a 12-position turret.

HIGH PERFORMANCE
Spindle speed up to 5000 rev/min and rapid feeds up to 20 m/min for efficient and productive machining.

ADVANCED CONTROL
Siemens Sinumerik 840D solutionline with ShopTurn module for 3D control and easy programming.

CAD/CAM INTEGRATION
Compatible with CATIA and SolidWorks via a dedicated postprocessor for a seamless workflow.

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C PROTOTYPING AND TESTING PROCESS

36 LASER ABLATION SYSTEM

The system is designed so that the LASER, optical parts, control system, and travel system are encased in a special housing with a granite table providing vibration damping and protection for Class 1 LASERS. This system is equipped with a diode-pumped solid-state laser (DPSS) operating in the visible spectrum, capable of drilling, polishing, and cutting thin materials such as metals, ceramics, and semiconductors. For accurate processing, the system is equipped with control systems for displacement along the X, Y, and Z axes.



The maximum size of the sample is 15 × 15 cm.

LASER SPECIFICATIONS:

- ✓ solid-state laser type DPSS emitting at 532 nm;
- ✓ the maximum laser power is 8 watts;
- ✓ the laser operates in pulsed mode. The pulse duration is less than 50 ns. Pulse length can be fixed or programmable in the range of 5–50 ns;
- ✓ pulse repetition rate between 1 kHz and 20 kHz / 21 kHz and 150 kHz;
- ✓ pulse-to-pulse energy stability of less than 3% RMS;
- ✓ the maximum beam divergence angle is less than 2 mrad;
- ✓ motorized X, Y, and Z axes.

AXIS SPECIFICATIONS (Z)

Parameter	Z
Travel (mm)	100
Resolution (µm)	0.5
Repeatability (µm)	± 1
Accuracy (µm)	± 6
Max Speed (mm/s)	100

AXIS SPECIFICATIONS (X, Y)

Parameter	X	Y
Travel (mm)	200	200
Resolution (µm)	0.25	0.25
Repeatability (µm)	± 0.75	± 0.75
Accuracy (µm)	± 2	± 2
Max Speed (mm/s)	250	250

APPLICATIONS:

- ✓ drilling (percussion and trepanning);
- ✓ cutting (circles, rectangles, slots);
- ✓ milling (rectangular pockets).

HIGH PRECISION
Accurate processing with excellent repeatability and positioning.

VERSATILE PROCESSING
Drilling, cutting and milling of metals, ceramics, semiconductors and other thin materials.

PULSED LASER TECHNOLOGY
Short pulse duration (< 50 ns) ensures high quality processing with minimal thermal impact.

3 AXIS CONTROL
Motorized X, Y and Z axes for precise and reliable positioning.

CLASS 1 LASER PROTECTION
Fully enclosed system ensuring operator safety.

C PROTOTYPING AND TESTING PROCESS

37 ANYCUBIC PHOTON M7 PRO – MSLA (MASKED STEREOLITHOGRAPHY) RAPID PROTOTYPING



The equipment builds high-resolution 3D parts using liquid photopolymer resin.

Masked Stereolithography (MSLA) is an additive manufacturing technology based on photo-polymerization, where a UV light source selectively cures liquid resin through an LCD mask to produce highly detailed models and prototypes.

PART READY TO PRINT
(positioned on the build platform and prepared for exposure)



During the photo-polymerization process, a high-resolution monochrome LCD screen works in conjunction with a powerful UV light source to cure entire layers simultaneously:

- resolution up to **14K** (high pixel density for ultra-fine prints);
- layer thickness as low as **10 µm**;
- maximum build volume: approximately **223 × 126 × 230 mm**;
- **high-speed printing** enabled by advanced light engine and optimized exposure control;
- suitable for detailed prototypes, dental models, miniatures, and precision components.
- **Resin auto-fill, dynamic temperature control** of the vat, **air purifier**

APPLICATIONS

- high-detail prototypes with fine geometrical features;
- dental models, aligners, and medical visualization parts;
- jewelry prototypes and molds for casting;
- miniatures, figurines, and artistic models;
- micro-mechanical components with tight tolerances;
- surface-critical parts requiring smooth finish and minimal post-processing;
- master patterns for silicone molding or investment casting.

ULTRA HIGH RESOLUTION
Up to 14K resolution for exceptional detail and ultra-fine prints.

ULTRA THIN LAYERS
Layer thickness as low as 10 µm for superior surface quality.

LARGE BUILD VOLUME
Build volume of 223 × 126 × 230 mm for versatile printing.

HIGH-SPEED PRINTING
Advanced light engine and optimized exposure control for faster production.

SMART FEATURES
Resin auto-fill, dynamic temperature control and air purification.

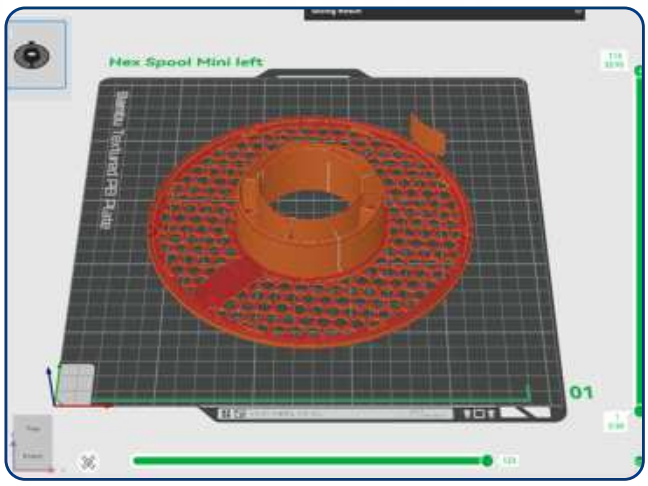
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C PROTOTYPING AND TESTING PROCESS

38 BAMBU LAB X1 CARBON 3D PRINTER – FUSED FILAMENT FABRICATION (FFF) RAPID PROTOTYPING

The equipment builds 3D parts using thermoplastic filament materials.

Fused Filament Fabrication (FFF) is an additive manufacturing technology that consists of melting and extruding thermoplastic filaments layer by layer to produce functional parts, prototypes, or end-use components with high dimensional accuracy.



During the fabrication process, a high-performance motion system controls the extrusion of heated filament through a precision nozzle, depositing material in successive layers:

- bryeing speed up to 0.00 mm/s;
- maximum build volume: 256 × 256 × 256 mm;
- supported materials: PLA, PETG, ABS, ASA, TPU, PA, PC, carbon/glass fiber reinforced filaments;
- enclosed chamber for improved thermal stability and print quality;
- automatic bed leveling.



APPLICATIONS

- functional mechanical parts and enclosures;
- prototyping of electronic housings and assemblies;
- jigs, fixtures, and tooling for laboratory or industrial use;
- structural components requiring mechanical strength and thermal resistance;
- customized adapters, mounts, and brackets;
- parts requiring impact resistance or flexibility (using TPU, nylon, etc.).

HIGH SPEED PRINTING
Printing speed up to 500 mm/s for fast and efficient prototyping.

ULTRA HIGH RESOLUTION
Layer resolution up to 0.08 mm for fine details and smooth surface finish.

LARGE BUILD VOLUME
Build volume 256 × 256 × 256 mm for versatile printing.

WIDE MATERIAL COMPATIBILITY
Supports engineering-grade materials including reinforced and flexible filaments.

SMART & RELIABLE
Enclosed chamber, automatic bed leveling and advanced sensors for consistent quality.

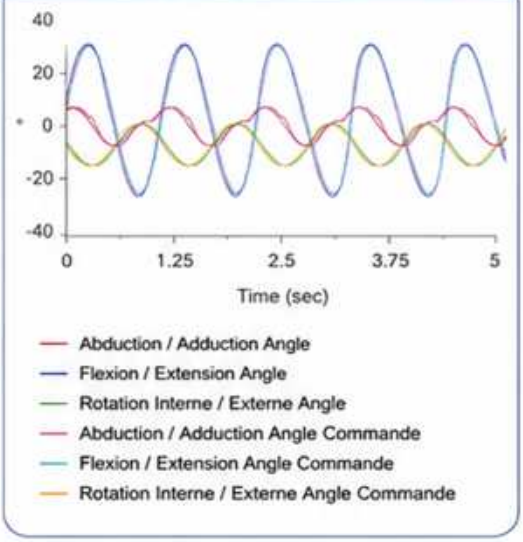
C PROTOTYPING AND TESTING PROCESS

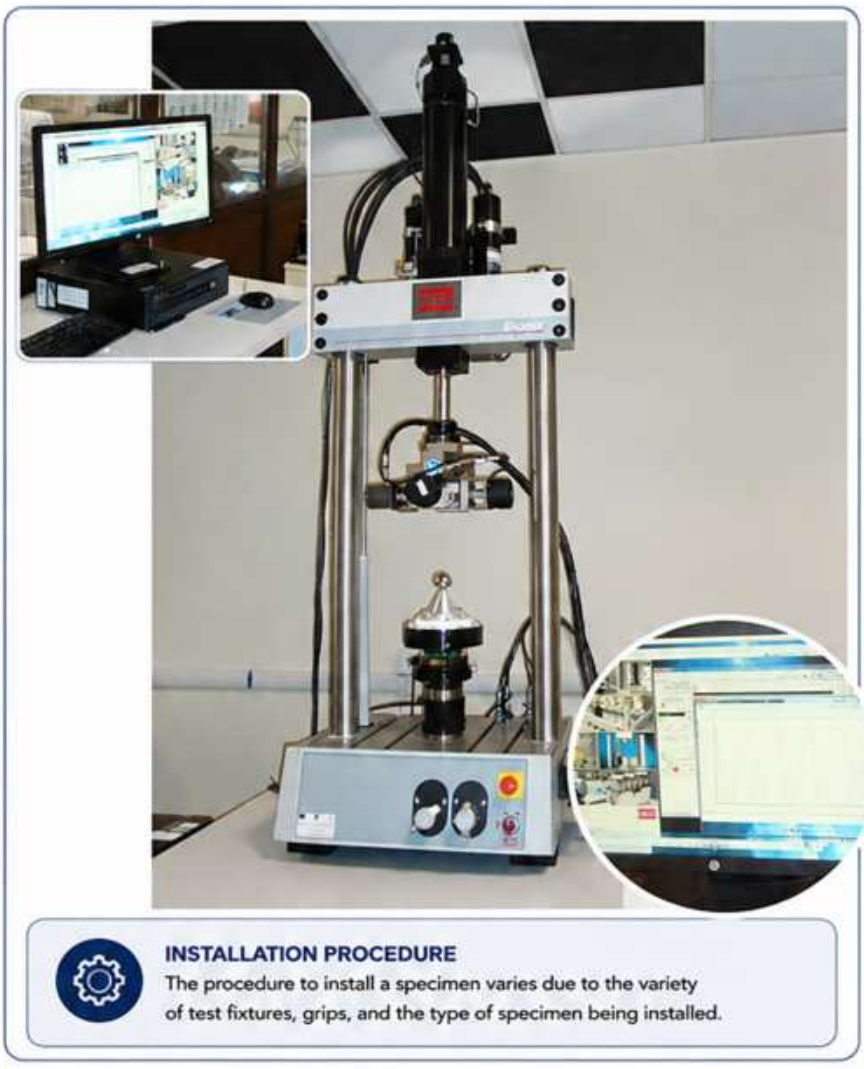
39 MTS BIONIX TESTING SYSTEM

The load unit is a stand-alone testing structure. It consists of the following components:

- ✔ load frame;
- ✔ crosshead lifts;
- ✔ manifold;
- ✔ actuators;
- ✔ servovalves;
- ✔ accumulators;
- ✔ two or more transducers.

GRAPH COMMAND - RESPONSE FOR DISPLACEMENT ANGLE FROM:
flexion-extension, abduction-adduction, rotation interne-rotation externe as function of time.





INSTALLATION PROCEDURE
The procedure to install a specimen varies due to the variety of test fixtures, grips, and the type of specimen being installed.

The hip-implant fixture-equipped MTS Bionic multi-axial load unit for mechanical parts allows testing orthopedic hip implants in terms of tribological behavior.
The system consists of 3 hydraulic rotary actuators, each controlled by a valve-manifold, powered by pressure regulators. The 3 actuators perform the 3 types of movement specific to the joint implant: internal-external rotation, flexion-extension and abduction-adduction.
The pressure exerted on the vertical axis can be set between 0–1500 kg, using the system software.

- The oil nominal pressure set on the hydraulic unit is 210 bar.
- The maximum flow rate is 57 L/min. The maximum frequency is 200 Hz.
- The maximum frequency is 200 Hz.

MULTI-AXIAL TESTING
Performs flexion-extension, abduction-adduction and internal-external rotation movements.

HIGH LOAD CAPACITY
Vertical load adjustable from 0 to 1500 kg for realistic conditions.

HIGH DYNAMIC RANGE
Maximum frequency of 200 Hz for accurate dynamic testing.

HYDRAULIC SYSTEM
Oil nominal pressure of 210 bar and maximum flow rate of 57

PRECISE CONTROL
Servo-hydraulic control with advanced software for reliable results.

RELIABLE & VERSATILE
Ideal for orthopedic implants and other mechanical components.

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C PROTOTYPING AND TESTING PROCESS

40 EXASCAN 3D PORTABLE SCANNER



The 3D Exascan portable scanner is a portable, optical, data acquisition system that captures every detail and provides high resolution exact geometries for an accurate representation of the scanned item.

The scanning process is of the plug & play type. It uses the triangulation method to determine its position relative to the part in real time.

It is a data acquisition system, and its own positioning system at the same time.

It is a precision research tool used in the field of mechanics, with multiple applications:

- reverse engineering / styling, design and analysis;
- quality control / inspection;
- museology / heritage preservation.



TECHNICAL SPECIFICATIONS	
Measurement rate	25,000 measurements/s
Resolution	0.2 mm
Accuracy	up to 0.040 mm (0.0016 in)
Depth of field	± 150 mm (± 6 in)
Volumetric accuracy (with MaxSHOT 3D)	minimum 0.020 mm + 0.025 mm/m (0.0008 in + 0.0003 in/Ft)
Software	VXelements, Catia V5, V6
Output format type	.dae, .fbx, .ma, .obj, .ply, .stl, .txt, .wrl, .x3d, .x3dz, .zpr

APPLICATIONS

- **Reverse engineering / styling, design and analysis**
- **Quality control / inspection**
- **Museology / heritage preservation**

HIGH ACCURACY
Accuracy up to 0.040 mm for precise and reliable 3D measurements.

HIGH SPEED
Up to 25,000 measurements per second for fast scanning.

WIDE DEPTH OF FIELD
± 150 mm depth of field for flexible scanning of various geometries.

PORTABLE & ERGONOMIC
Lightweight, handheld design for easy use anywhere.

VERSATILE SOFTWARE
Compatible with VXelements, Catia V5, Catia V6.

MULTIPLE OUTPUT FORMATS
Export to .dae, .fbx, .ma, .obj, .ply, .stl, .txt, .wrl, .x3d, .x3dz, .zpr.

C PROTOTYPING AND TESTING PROCESS

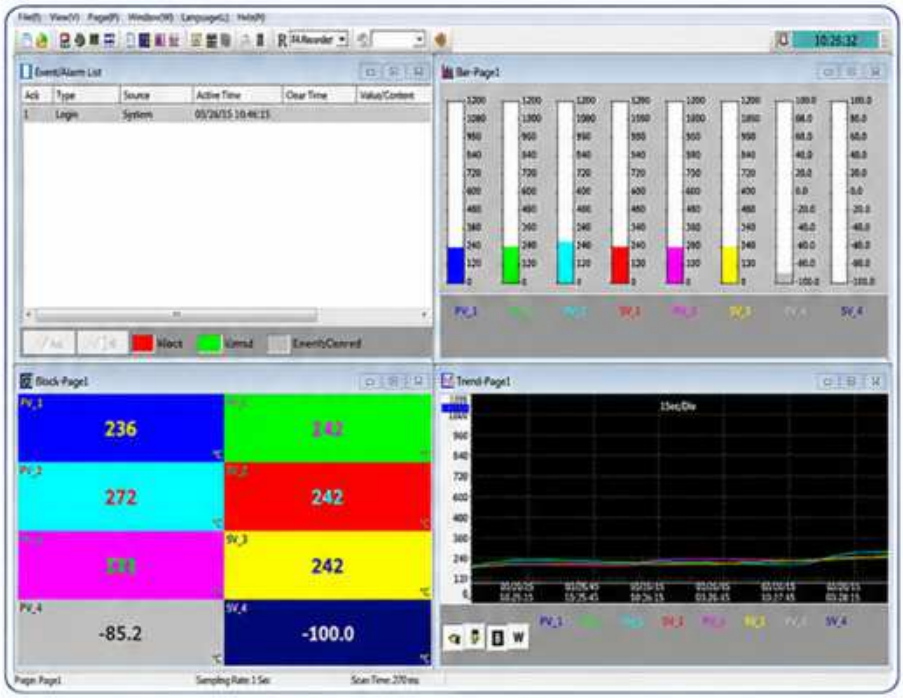
41 HEAT TREATMENT OVEN

Heat treatment oven is an electric oven with rapid heating which is used both for the controlled heating and heat treatments at temperatures up to 1100°C, as well as impurities diffusion in the material. Also, it can be used in the synthesis of metal materials or alloys.

The oven includes a quartz tube with diameter of 125 mm and length of 1400 mm. At both ends of the quartz tube it has a pair of flanges for connection to the vacuum booster pump and the carrier gas / thermocouple.

The temperature is controlled so as to have a very high stability on a broad landing and provide an increase or decrease in temperature with ± 1°C. The heating zone is 800 mm, heating rate 20°C/min and temperature control can be done either manually (by temperature programming with the regulator of the electronic box) and automatically using the computer provided.





TECHNICAL SPECIFICATIONS

Maximum temperature	1100°C
Quartz tube	Diameter: 125 mm Length: 1400 mm
Heating zone	800 mm
Heating rate	20°C / min
Temperature stability	± 1°C
Temperature control	Manual and automatic (via computer)
Atmosphere connections	Vacuum pump and carrier gas / thermocouple
Controller	PID microcontroller with overheating protection and alarm

HEAT TREATMENT ANALYSIS: PARAMETERS, HEATING DIAGRAM AND RECORDED TEMPERATURES IN REAL TIME

Programmed parameters (temperature and time) and pressure are digitally displayed. Also, the display shows the time for each land. The oven can be programmed for automatic shutdown and it is announced by audible warning, but it can be stopped any time. It is equipped with a microcontroller PID with overheating protection and alarm.

RAPID HEATING
Heating rate up to 20 °C/min for efficient heat treatments.

HIGH TEMPERATURE
Maximum operating temperature up to 1100 °C.

HIGH STABILITY
Temperature stability of ± 1 °C on a broad landing.

SMART CONTROL
Manual programming or automatic control via computer.

SAFETY PROTECTION
PID controller with overheating protection and alarm.

VERSATILE APPLICATIONS
Heat treatments, diffusion processes, synthesis of materials

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D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

42 CHARACTERIZATION SYSTEM MODULE AND SOLAR CELLS ORIEL SOL3A CLASS AAA SOLAR SIMULATORS

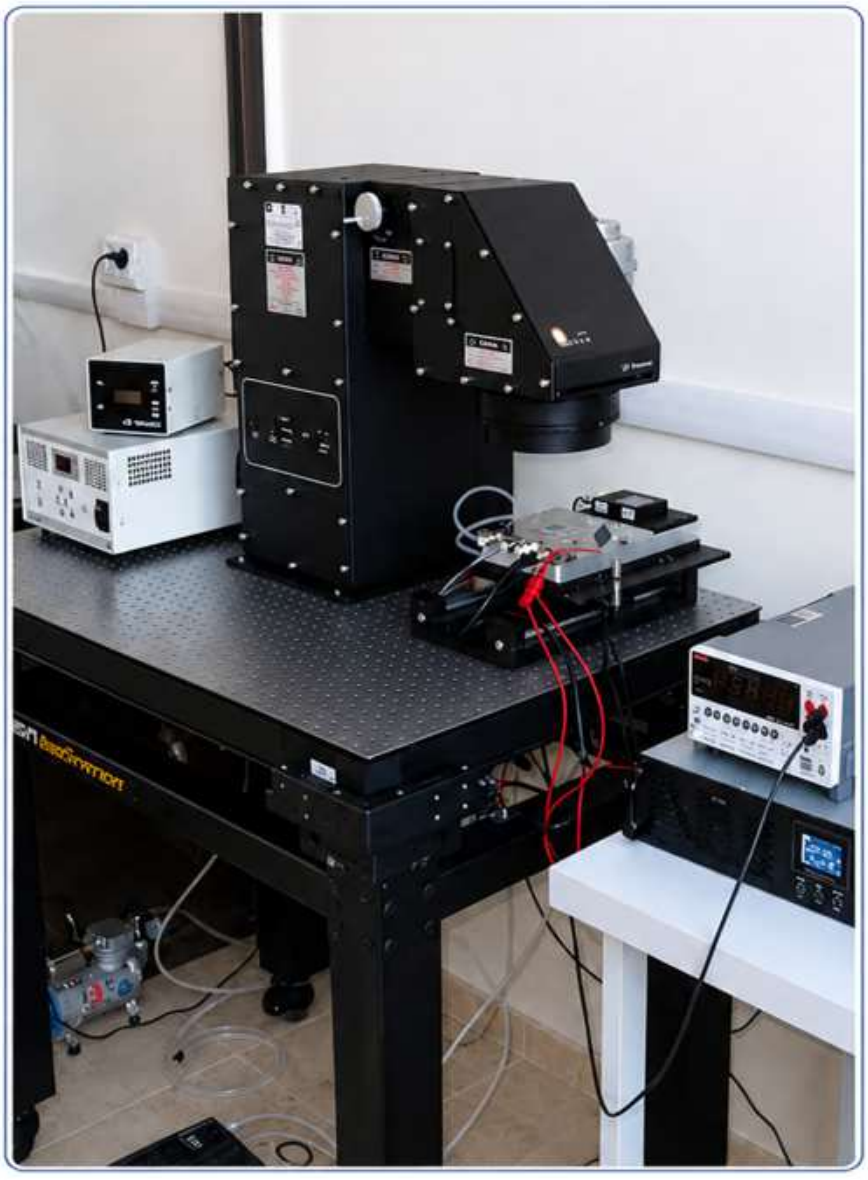
The Oriel Sol3A simulator use a single lamp design to meet not one or two, but all three performance criteria without compromising the 1 Sun output power, providing true Class AAA performance.

Oriel Sol3A also integrates a partial sun attenuating device to allow easy variation of the output from 0.2 -1.0 suns with the simple turn of a knob.

The Oriel Sol3A uses a black non-reflective finish to minimize stray light, incorporates captive screws for all panels requiring user access to facilitate lamp replacement, alignment, and filter changes, and incorporates safety interlocks to prevent inadvertent exposure to UV light.

Photovoltaic (PV) cell research and manufacturing are evolving rapidly, with new technologies like thin film processes, tandem junction and multi-junction cells, organic thin films and dye sensitized cells all requiring careful evaluation of their performance.

The Sol3A solar simulators have been designed to meet Class A performance for all 3 of the test requirements, Spectral Match, Non-Uniformity of Irradiance, and Temporal Instability of Irradiance as called out by IEC 60904-9 Edition 2 (2007) edition, JIS C 8912, and ASTM E 927-05.



CLASS AAA PERFORMANCE
Meets all three criteria without compromising 1 Sun output power.

PARTIAL SUN ATTENUATION
Output easily adjustable from 0.2 - 1.0 suns with a simple turn of a knob.

LOW STRAY LIGHT
Black non-reflective finish minimizes stray light for accurate results.

USER FRIENDLY DESIGN
Captive screws for all panels requiring access for lamp replacement, alignment, and filter changes.

SAFETY FIRST
Safety interlocks prevent inadvertent exposure to UV light.

STANDARDS COMPLIANCE
Designed to meet Class A performance for IEC 60904-9 Ed. 2 (2007), JIS C 8912, and ASTM E 927-05.

D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

43 ORIEL INSTRUMENT'S IQE-200 MEASUREMENT SYSTEM

Oriel Instrument's IQE-200 system allows the measure of External Quantum efficiency (EQE) also known as Incident Photon to Charge Carrier Efficiency (IPCE) as well as Internal Quantum Efficiency (IQE) for solar cells, detectors, or any other photon-to-charge converting device.

OPERATING PRINCIPLE:

The electronic band structure in a photovoltaic device introduces a wavelength dependent optical absorptivity. A photon with energy larger than the band gap is typically absorbed by the material, while the material is transparent for a photon with energy smaller than the band gap. The absorbed photon energy creates an electron-hole pair, which leads to creation of photocurrent. The spectral response for a photovoltaic device is dependent on this induced photocurrent and on the wavelength of incident light.

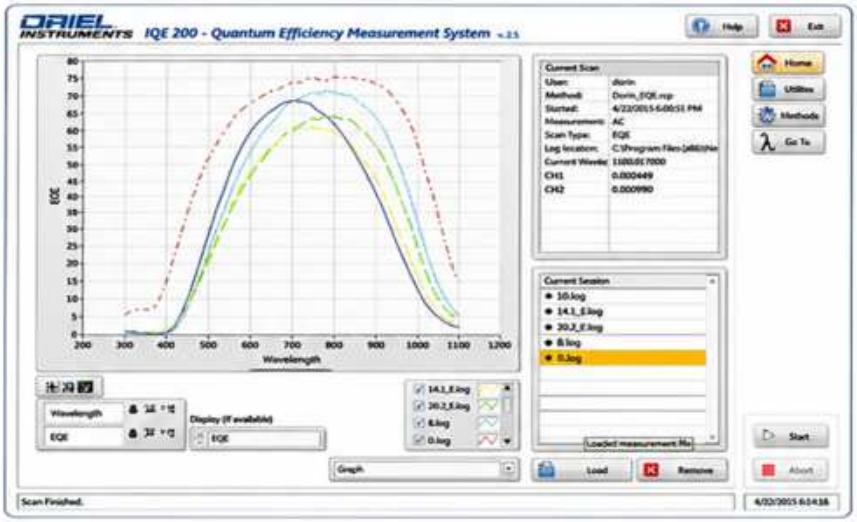
The IQE-200 System uses a 250W QTH lamp as the light source for the monochromatic light for the system. The monochromatic (1nm spectral resolution) modulated beam is obtained using the system consisting of the filter wheel, the chopper, and the 1/8th meter monochromator.

The three – way beam splitter delivers the light simultaneously to the sample and to the reference detector. The PC controls, the monochromator, the lock-in amplifier as well as the multiplexer used for simultaneous data acquisition from the three detectors.

RESULTS:

The QE software performs the needed computations and calibrations. The power spectral responsivity, Rpa, for collected electrons per incident photons may be converted to external quantum efficiency, QE and then to internal quantum efficiency, IQE.





CLASS AAA PERFORMANCE
Meets all three performance criteria: Spectral Match, Non-Uniformity of Irradiance and Temporal Instability.

ADJUSTABLE OUTPUT
Partial sun attenuating device allows easy variation of the output from 0.2 – 1.0 suns with the turn of a knob.

LOW STRAY LIGHT
Black non-reflective finish minimizes stray light for accurate measurements.

USER ACCESS FRIENDLY
Captive screws for all panels requiring access for lamp replacement, alignment and filters.

SAFETY INTERLOCKS
Safety interlocks prevent inadvertent exposure to UV light.

STANDARD COMPLIANCE
Designed to meet Class A performance per IEC 60904-9 Ed. 2 (2007), JIS C 8912, and ASTM E 927-05.

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D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

44 PRINTED CIRCUIT BOARD PROTOTYPING LINE

PCBs offer both mechanical and electrical support for connections between electronic components. The PCB line provides the possibility of developing a complete functional electronic circuit, starting from the basic design of the electronic circuit in a CAD program through to the final stage of testing its electrical and electronic functionality.





The laboratory's PCB line contains the following technologies:

Desktop PC: for controlling the ProtoMat S103 machine and for CAD software processing of electronic schematics and boards as well.

ProtoMat S103: a 3-axis plotter with an auto-tool magazine, designed for mechanical copper removal of FR4 PCBs or flexible PCBs, with maximum dimensions of 210 mm × 297 mm. It supports single-layer, double-layer, and multilayer boards using milling and drilling processes. The machine has a material processing speed of 150 mm/s, a rotational speed of 100,000 rpm, and a resolution of 0.25 µm. It is equipped with an illuminated video camera for position detection and PCB size identification, as well as a vacuum system for secure PCB holding and aspiration of microparticles generated during mechanical processing.

Contac RS & Via Cleaner: chemical bath equipment for electrogalvanization preparation of PCBs requiring through-hole plating. The equipment includes bath temperature monitoring, preset user profiles with probe movement, and automated process termination. The maximum PCB dimensions supported are 460 mm × 330 mm.

ProMask/ProLegend: kits for applying masks and legends on PCBs, providing solder resistance.

UV Unit: UV treatment unit for polymerization of masks applied to PCBs, supporting maximum PCB dimensions of 210 mm × 297 mm.

Unox: hot-air oven for thermal curing of masks and legends applied to PCBs, supporting maximum PCB dimensions of 210 mm × 297 mm.

ProtoPrint S: precision manual stencil printer for solder paste placement on PCBs with maximum dimensions of 210 mm × 297 mm.

ProtoPlace S: semi-automated vacuum equipment for SMD component and solder paste placement on PCBs with maximum dimensions of 297 mm × 420 mm. It is equipped with a video camera and monitor, an adjustable table, and a rotary magazine for electronic component handling. The system also features an XYZ locking mechanism to enhance overall placement precision.

ProtoFlow S: convection reflow oven for soldering SMD electronic components on PCBs. The oven includes three temperature sensors for monitoring thermally sensitive components mounted on the PCB. It supports programmable user profiles, has an insertion area of 200 mm × 160 mm, and can accommodate multiple boards simultaneously.

Hameg HMO724: DSO-generation oscilloscope used for the measurement and analysis of electrical signals from electronic circuits, as well as for testing electronic components and their characteristics, including voltage and time measurements, impedance, voltage drop, frequency, harmonics, analog and digital signals, ripple, and related parameters.

Konstanter SLP: laboratory programmable power supply (20 V / 10–20 A) used for powering and testing electronic circuits.

COMPLETE PCB PROCESS
From design in CAD to a fully tested and functional electronic circuit.

HIGH PRECISION
Advanced equipment for precise milling, drilling, and component placement.

OPTICAL INSPECTION
Video cameras and illumination systems for accurate alignment and quality control.

CLEAN & SAFE PROCESS
Vacuum systems and interlocks ensuring clean working conditions and user safety.

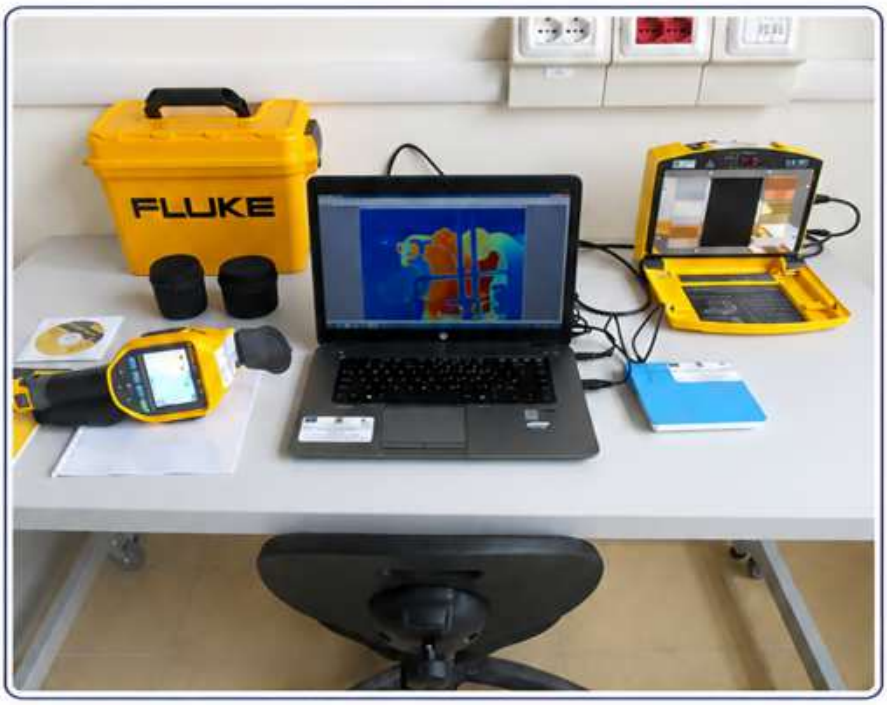
THERMAL CONTROL
Temperature monitoring and profiling for reliable soldering and curing processes.

TEST & MEASURE
Professional instruments for electrical testing and signal analysis.

RELIABLE RESULTS
Consistent performance for research, education, and prototyping.

D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

45 FLUKE TI400 THERMAL IMAGER



SHORT DESCRIPTION OF THE EQUIPMENT – BASIC CHARACTERISTICS:

- ✓ standard infrared lens and autofocus with technology LaserSharp;
- ✓ temperature range : -20°C and 1200°C;
- ✓ thermal sensitivity: ≤ 0.05°C at a target temperature of 30°C;
- ✓ resolution: 320 x 240 (76,800 pixels);
- ✓ spatial resolution: 1.31 mRad;
- ✓ field of view: 24° horizontal x 17° vertical.

TYPES OF TESTS:

- identification of hot spots in electrical installations;
- thermal inspection of mechanical systems (motors, pumps, etc.);
- supervision of industrial processes;
- scanning thermal heating systems, furnaces;
- viewing areas with air or water leaks at home;
- scanning thermal insulation of buildings and assessment.

SAMPLE TYPE:
electrical, electronic circuits, mechanical systems, buildings.

APPLICATION AREAS:
energy, electrical, electronics and microelectronics, motor industry, oil and metallurgy / steel.

LASERSHARP AUTOFOCUS
Accurate focus and sharp image at any distance.

WIDE TEMPERATURE RANGE
From -20°C up to 1200°C for versatile applications.

HIGH RESOLUTION
320 x 240 resolution (76,800 pixels) for detailed images.

EXCELLENT SPATIAL RESOLUTION
1.31 mRad for precise detection of small targets.

WIDE FIELD OF VIEW
24° horizontal x 17° vertical for large area coverage.

RELIABLE & DURABLE
Designed for demanding industrial and field conditions.

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D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

46 HDO6104-MS HIGH DEFINITION OSCILLOSCOPE



SHORT DESCRIPTION OF THE EQUIPMENT – BASIC CHARACTERISTICS:

- ✓ bandwidth: 350 MHz – 1 GHz;
- ✓ analogic channels: 4;
- ✓ digital channels: 16;
- ✓ sample rate (all channels): 2.5 GS/s;
- ✓ memory (per channel): 50 Mpts/ch;
- ✓ digital sample rate: 1.5 GS/s;
- ✓ minimum detectable pulse width: 2 ns;
- ✓ maximum input frequency: 250 MHz.

SAMPLE TYPE:
electrical and electronic components and circuits.

APPLICATION AREAS:
energy, electrical, electronics and microelectronics.

TYPES OF TESTS:

- the ability to locate unusual events in a single capture – **WaveScan** function;
- report generation for the waveform and the possibility of direct annotation on the oscilloscope screen – **LabNotebook** function;
- playback – scroll back for previous time waveform and isolating signal anomalies – **History** function;
- automatic determination of peak frequency – display markers, interactive tables with the frequency, automatic identification and marking of the fundamental frequency and harmonics;
- spectrogram which can display a 2D or 3D history of the frequency content (how the spectrum changes in time).

HIGH BANDWIDTH
350 MHz – 1 GHz for precise signal analysis.

FOUR ANALOG CHANNELS
Simultaneous acquisition and comparison of multiple signals.

16 DIGITAL CHANNELS
Mixed signal analysis with full digital visibility.

HIGH SAMPLE RATE
Up to 2,5 GS/s on all channels for accurate waveform capture.

DEEP MEMORY
50 Mpts/ch for long record length and detailed analysis.

WAVEFORM PRECISION
2ns minimum detectable pulse width and up to 250 MHz input frequency.

D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

47 ENERGY ANALYZER c.a.

The c.a. 8335 (Qualistar+) is a three-phase network analyzer with colour graphic display and built-in rechargeable battery.
It plays three roles, and can be used:

- ✔ to measure the RMS values, powers, and perturbations of electric distribution networks;
- ✔ to deliver a snapshot of the principal characteristics of a three-phase network;
- ✔ to track the variations of various parameters over time.

The measurement uncertainty of the device is better than 1% (not counting the uncertainties due to the current sensors). The device is also very flexible, with a choice of sensors allowing measurements ranging from a few milliamperes (MN93A) to several kiloamperes (AmpFLEX™).
The device is compact and impact resistant.
The ergonomics and simplicity of its interface make using it pleasant.
The C.A 8335 is intended for the technicians and engineers of electrical installation and network inspection and maintenance teams.



SHORT DESCRIPTION OF THE EQUIPMENT – BASIC CHARACTERISTICS:

- ✔ bandwidth: 350 MHz – 1 GHz;
- ✔ analogic channels: 4;
- ✔ digital channels: 16;
- ✔ sample rate (all channels): 2.5 GS/s;
- ✔ memory (per channel): 50 Mpts/ch;
- ✔ digital sample rate: 1.5 GS/s;
- ✔ minimum detectable pulse width: 2 ns;
- ✔ maximum input frequency: 250 MHz.

SAMPLE TYPE:
electrical and electronic components and circuits.

APPLICATION AREAS:
energy, electrical, electronics and microelectronics.

THE PRINCIPAL MEASUREMENTS MADE ARE:

- ✔ the RMS values of AC voltages up to 1000 V between terminals. By using the ratios, the device can measure voltages up to hundreds of gigavolts;
- ✔ the RMS values of AC currents up to 6500 amperes (neutral included). By using the ratios, the device can measure currents up to hundreds of kiloamperes;
- ✔ the DC components of voltages and currents (neutral included);
- ✔ minimum and maximum half-cycle RMS voltage and current values (excluding neutral);
- ✔ peak voltage and current values (neutral included);
- ✔ the frequency of 50 Hz and 60 Hz networks;
- ✔ current and voltage peak factors (neutral included);
- ✔ calculation of the harmonic loss factor (FHL), application to transformers in the presence of harmonic currents;
- ✔ calculation of the K factor (KF), application to transformers in the presence of harmonic currents;
- ✔ measurement of total harmonic distortion with respect to the fundamental (THD in % f) of the current and of the voltages (excluding neutral);
- ✔ measurement of the total harmonic distortion with respect to the RMS AC value (THD in % r) for the current and the voltages (neutral included);
- ✔ active, reactive (capacitive and inductive), non-active, distortion, and apparent power, by phase and cumulative (excluding neutral);
- ✔ power factors (PF) and displacement factors (DPF or cos Φ) (excluding neutral);
- ✔ measurement of the RMS distortion values (d) for the current and the voltages (excluding neutral);
- ✔ short-term voltage flicker (PST) (excluding neutral);
- ✔ measurement of the long-term flicker of the voltages (PLT) (excluding neutral);
- ✔ active, reactive (capacitive and inductive), non-active, distortion, and apparent energy (excluding neutral);
- ✔ current and voltage harmonics (excluding neutral) up to order 50: RMS value, percentage referred to the fundamental, (%f) (excluding neutral), or the total RMS value (%r), minimum and maximum and sequence harmonics;
- ✔ apparent power of each harmonic up to order 50 (excluding neutral): value, percentage referred to the fundamental apparent power (%f) or the total apparent power (%r), minimum and maximum;
- ✔ inrush currents, starting of motor.

WAVESCAN
Locate unusual events in a single capture.

LABNOTEBOOK
Generate reports and annotate directly on the screen.

HISTORY
Scroll back in time to isolate signal anomalies.

AUTOMATIC FREQUENCY
Automatic peak frequency detection and harmonics identification.

SPECTROGRAM
2D or 3D history of frequency content over time.

BUILT-IN BATTERY
Rechargeable battery for extended field autonomy.

RUGGED & RELIABLE
Compact, impact resistant and ready for field use.

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D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

48 GAS ANALYZER THREE SENSORS KIGAZ 200 PRO



DESCRIPTION / TESTS:

KIGAZ Tool 200 is a gas analyzer that can be supplied with two interchangeable sensors (O_2 and CO - H_2) being able to add another sensor (NO or CH_4) and three interchangeable sensors (O_2, CO, H_2 and NO) having the possibility to add a 4th sensor (CH_4).

MAIN FUNCTIONS:

- ✓ autozero duct;
- ✓ protection of CO sensor with a solenoid valve;
- ✓ LED illumination probe handle in dark places;
- ✓ condensate Trap outdoor;
- ✓ screen 3.5 greyscale;
- ✓ 2 connectors for thermocouples;
- ✓ memory 2GB.

KIT CONTAINS:

holster with magnet, silicone hoses 2x1 m, probe gas sampling a single connector, length 300 mm condensate trap and light source, Li-Ion battery, power supply, software ligase (database creation and issue certificate verification), USB cable, carrying case, built-in printer.

TECHNICAL CHARACTERISTICS:

- ✓ comax. ambient CO exhaust gas air excess yield%, differential pressure, circulation, ambient temperature and cart, DT, DHW temperature, dew point, 15 + 5 predefined fuels fuels choice smoke index.
- ✓ automatic measurement, autotest, issue and print directly test certificate, CO-H_2 sensor protection by solenoid valve, 2 inputs for thermocouple measurements 100.000 memory.
- ✓ O_2 measurement range: 0 ... 21% Vol.
- ✓ CO (low range) measurement range: 0 ... 8.000 ppm
- ✓ CO (high range) measurement range: 0 ... 8% Vol.
- ✓ H_2 measurement range: 0 ... 2.000 ppm
- ✓ NO measurement range (optional): 0 ... 5.000 ppm
- ✓ CH_4 measurement range (optional): 0 ... 10% Vol.
- ✓ Operating temperature: -5 ... +45°C
- ✓ Storage temperature: -20 ... +50°C
- ✓ Battery: Li-Ion rechargeable
- ✓ Dimensions: 220 x 85 x 55 mm
- ✓ Weight: approx. 650 g

THREE (OR FOUR) SENSORS
Configurable with O_2, CO, H_2 and optionally NO or CH_4 sensors.

SENSOR PROTECTION
CO sensor protection with solenoid valve for extended life.

CONDENSATE TRAP
External condensate trap to protect the analyzer.

CLEAR DISPLAY
3.5" greyscale screen for clear and easy data visualization.

TEMPERATURE INPUTS
2 connectors for thermocouples for precise temperature measurements.

LARGE MEMORY
2GB memory for data storage up to 100.000 records.

BUILT-IN PRINTER
Print test certificates directly on site for professional reports.

D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

49 ICSTM DATA CENTER

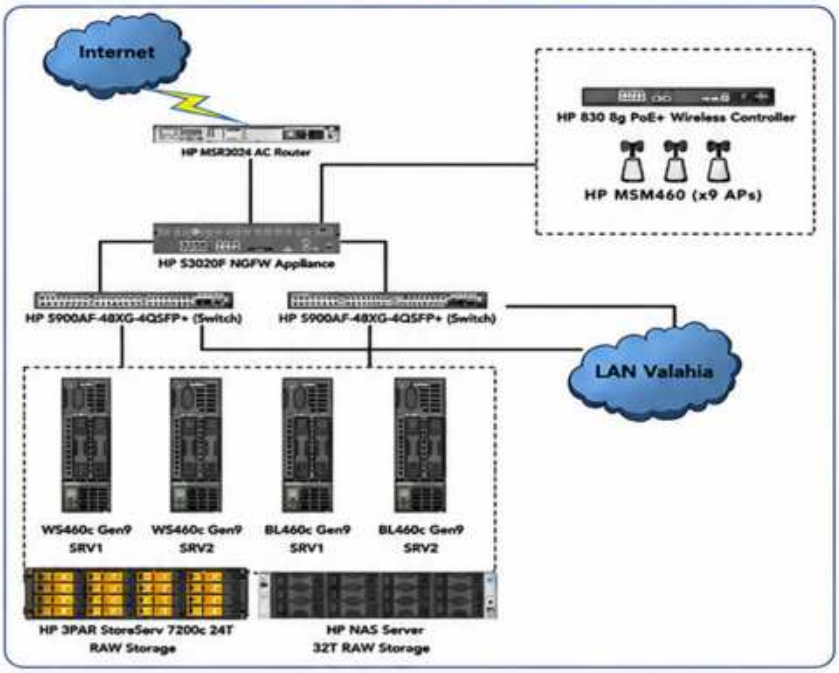
DC Enterprise infrastructure fully redundant N+1 (Tier 2). Comprised of 16U blade servers Enclosure (HP C7000), with installed 2 servers (HP Blade System Proliant BL460Gen9 – 2x Xeon 2.6 GHz 32 logical processors, 64 GB RAM) and 2 workstation blade (HP Blade System Proliant WS460Gen9 – 2x Xeon 2.6 GHz 32 logical processors, 64 GB RAM, Nvidia Grid K2 – 2x Kepler GPU 1536 cores per GPU, 8 GB GDDR5).



Fast Storage Array: HP 3PAR with 24 TB RAW storage, 4× FCoE 8 Gbps + 4× Fibre Optic 10 Gbps connections, and one NAS server with 32 TB RAW storage and 4× Ethernet 1 Gbps interfaces.

NOC Infrastructure (enterprise-grade) comprises:

- Router: HP MSR3024 AC Router;
- Next Generation Firewall: HP S3020F NGFW Appliance;
- 2× TOR switches: HP 5900AF-48XG-4QSFP+;
- Wireless controller and 9 access points (HP 830 8G PoE+ AP and HP MSM460 AP).



The ICSTM Cloud is based on the hardware configuration described above and includes:

- Two servers configured in a failover cluster for networking services;
- A second cluster integrating two workstation servers for the Virtual Desktop Infrastructure (VDI), based on the Xen Desktop solution.



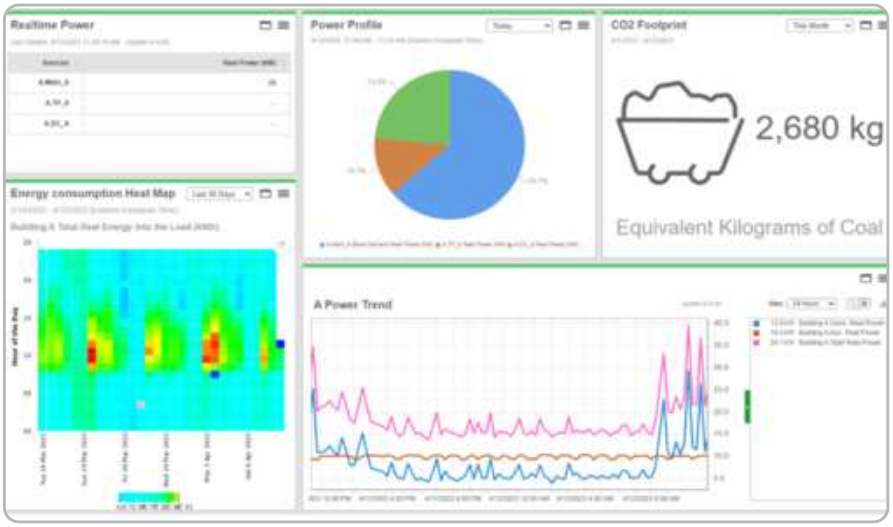
TIER 2 DATA CENTER	BLADE SERVERS	STORAGE	NETWORK INFRASTRUCTURE	ICSTM CLOUD	SECURITY	MANAGEMENT
Fully redundant N+1 infrastructure for high availability.	HP C7000 Enclosure with 2 BL460 Gen9 and 2 WS460 Gen9 blades.	HP 3PAR 24 TB RAW storage (4× FCoE 8 Gbps + 4× Fibre Optic 10 Gbps) and NAS 32 TB RAW.	Router, Next Generation Firewall, 2× TOR switches, and a wireless controller with 9 access points.	Failover Cluster for networking services and a VDI Cluster based on Xen Desktop.	Next Generation Firewall for advanced protection and threat prevention.	Intelligent Management Center for monitoring, alerts, and centralized management.

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D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

50 ENERGY MANAGEMENT SYSTEM – EMS CAMPUS UVT UVT – EMS

Integrated EMS-type (Energy Management System) monitoring system for the university's campus buildings (1x rectorate office, 2x academic buildings, 1x research institute, 3x student dormitories). It ensures the acquisition and analysis of measured data from electricity and natural gas meters.



It performs general metering and sub-metering of the loads (measurement at the service connection point plus measurement of auxiliary consumers: thermal power plants/boiler houses, data centers, heat pumps/chillers, ventilation units, etc.).

It consists of electricity meters and power quality analyzers (Schneider iEM3000, PM3000, PM5000, PM8000 series) on the electrical vector, and gas meters with volumetric correction (rotary piston meters ITRON and diaphragm meters ELSTER) on the natural gas vector.

The system is hosted at the EDGE computing level within the ICSTM research institute data center and is Cloud connected to Schneider Microgrid Advisor platform servers. It is also integrated with controllers from different third-party manufacturers: Victron, SMA, ABB, and Resol.

Through this integration, energy production is measured from the following systems:

- photovoltaic (PV) microgrid with storage
- on-grid PV systems
- wind energy systems
- solar thermal system with storage operating as heat input for the ICSTM HVAC system.

Data storage and interpretation can be performed in detail at the local level and at a top-level/administrative level from the cloud.

The system enables analysis by consumption profile categories (office, teaching, laboratory, and residential), at the building level, or differentiated between consumption generated by core activities and support/auxiliary consumption (HVAC, Data Center, and specific installations supporting RDI laboratory activities).

ELECTRICAL VECTOR – METERS & POWER QUALITY ANALYZERS

Schneider Electric PowerLogic

- iEM3000 / PM3000 / PM5000 / PM8000 series
- Energy meters and power quality analyzers
- Real-time measurements of energy, power quality, harmonics, and events
- Communication: Modbus, Ethernet, BACnet, etc.



NATURAL GAS VECTOR – GAS METERS WITH VOLUMETRIC CORRECTION

ITRON & ELSTER

- Rotary piston meters (ITRON)
- Diaphragm meters (ELSTER)
- Built-in temperature and pressure compensation
- High accuracy and reliability



CAMPUS ANALYTICS – DETAILED CONSUMPTION & PERFORMANCE DASHBOARDS



INTEGRATED EMS
Complete monitoring of electricity and natural gas consumption across the campus.

REAL-TIME MONITORING
Live data acquisition and analysis for informed decision-making.

ENERGY ANALYTICS
Consumption profiles, trends, heat maps, and performance indicators.

CLOUD CONNECTED
Hosted on Edge infrastructure and connected to Schneider Microgrid Advisor.

MULTI-ENERGY SOURCES
Integration of PV, wind, energy storage, and solar thermal production systems.

RELIABILITY & SECURITY
Secure, scalable, and redundant infrastructure ensuring high availability.

D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

51 ICSTM BUILDING MANAGEMENT SYSTEM

Integrated remote monitoring and control system of BMS type (Building Management System or Building Automation and Control System - BACS) for the ICSTM building installations. It ensures control of HVAC systems (cooling unit – chiller, boiler plant with two boilers and four hydraulic distribution circuits, 3 air handling units, fan coil units) as well as lighting in laboratories and corridors.

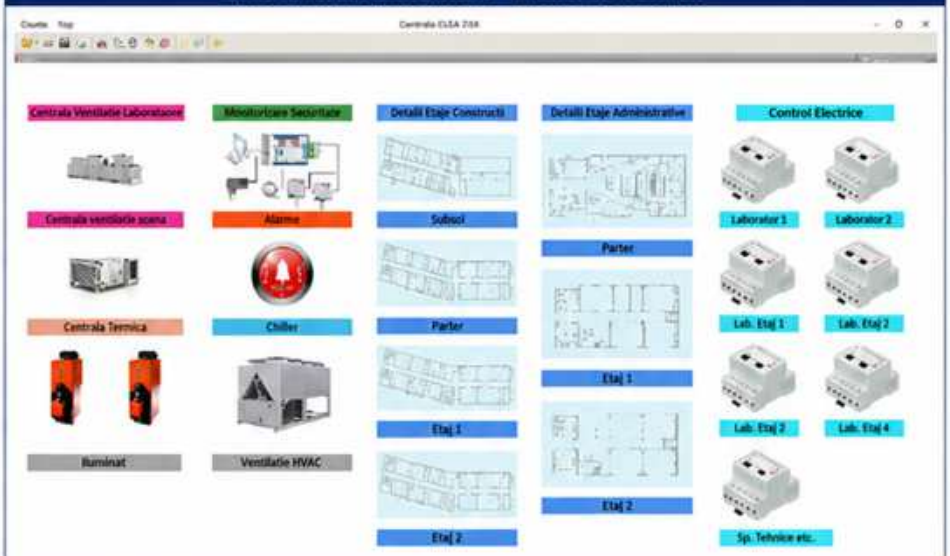
It monitors fire alarm, intrusion detection, access control, hazardous gas emissions, electrical consumption at laboratory level, and the groundwater perimeter drainage network.

The system is composed of 8 PLC automation controllers (CLEA2026B21) and multiple combined input/output modules (CLIOP831A and CLIOP824A).

The system includes sensors for temperature, pressure, air quality, noise, and atmospheric gas emission detection (CO, acetylene, hydrogen).

The system integrates communication with the boiler plant, chiller, air handling units, fire alarm control panel, intrusion alarm system, room thermostats, and electricity meters.

BMS SUPERVISION INTERFACE – CENTRALA CLEA 2.0X



PLC AUTOMATION CONTROLLER – CLEA2026B21



COMBINED INPUT/OUTPUT MODULES – CLIOP831A & CLIOP824A



INTEGRATED MONITORING & CONTROL
Centralized supervision and real-time control of all building systems.

HVAC MANAGEMENT
Control of chillers, boilers, AHUs, fan coil units and hydraulic circuits.

SAFETY & SECURITY
Fire alarm, intrusion detection, access control and gas emissions monitoring.

ENERGY MANAGEMENT
Monitoring of electrical consumption at laboratory level and reporting.

ENVIRONMENTAL SENSORS
Temperature, pressure, air quality, noise and gas emission detection.

SYSTEM INTEGRATION
Communication with BMS equipment and third-party systems and devices.

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D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

52 EXPERIMENTAL PHOTOVOLTAIC PLATFORM ICSTM – PV

Experimental Photovoltaic PV generator configured in microgrid system (9x single phase inverter cluster with 6x on-grid AC component coupled in a 0.4 kV local distribution system) with electrical battery backup BESS and surplus energy thermal conversion with water-based heat storage system TESS.



2 – 42.5 kWp MICRO-GRID BIPV
(BUILDING-INTEGRATED PHOTOVOLTAICS)
SUN-SHADING 60° AND CURTAIN FAÇADE 90° INSTALLATION



1 – 33.15 kWp ON-GRID ROOFTOP BAPV
(TERRACE-MOUNTED) – 33° INSTALLATION

1 33.15 kWp On-Grid rooftop BAPV (terrace-mounted) – 33° installation

Comprising mono-/poly-/amorphous silicon and CIGS PV modules, with transformerless on-grid inverters:

- 70 × Q.Cells Q.Pro-G3 245 Wp
- 70 × Calyxo CX3 80 Wp
- 40 × Bauer Solartechnik BS-260-6MB-5 260 Wp
- 6 × SMA 5000TL-21 5 kW

2 42.5 kWp Micro-Grid BIPV (Building-Integrated Photovoltaics) Sun-shading 60° and curtain façade 90° installation

Comprising polycrystalline silicon PV modules and hybrid inverters:

- 120 × Altius AFP semi-transparent 250 Wp
- 51 × Q.Cells Q.Pro-G3 BLK 245 Wp
- 7 × Victron Multiplus 5 kW
- 2 × Victron Multiplus 3 kW
- 10 × Tesla NCA module batteries, 1000 Ah, 50 kWh

3 3.75 kWp Large Array Solar Tracker

Two-axis large array solar tracker with active positioning, 25 m^2:

- 15 × Q.Cells Q.Pro-G3 BLK 245 Wp
- 2 × Fronius 5 kW inverter(s)

4 Experimental two-axis mobile tracker

- 10 × Solibro SL2 CIGS 120 Wp
- 10 × Ascent Solar WaveSol-2 flexible 50 Wp

5 Environmental parameter monitoring system

Solar tracker: Kipp & Zonen Solys 2 equipped with:

- 3 × CMP22 pyranometers
- 1 × CGR4 pyrgeometer
- 1 × CHP1 pyrheliometer

Data logger: Campbell Scientific CR1000, configured according to Baseline Surface Radiation Network (BSRN) standards.

EXPERIMENTAL PHOTOVOLTAIC PLATFORM ICSTM – PV

The ICSTM Experimental Photovoltaic Platform enables research, testing, and demonstration of advanced PV technologies integrated into a microgrid with battery energy storage systems (BESS) and thermal energy storage systems (TESS). The platform supports energy efficiency, renewable energy integration, and the development of smart campus solutions.

D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

53 EXPERIMENTAL SOLAR-THERMAL PLATFORM ICSTM - ST

Experimental Solar Thermal installation with water-based heat storage system TESS coupled with the ICSTM HVAC system for energy input in both forms: heat and cold. The system provides pre-conditioning of fan coils or air handling units hydraulic circuits.

Two of the hot water storage tanks are electrified for power to heat conversion in order to use surplus PV generation.







1 26 kWp solar thermal installation for thermal contribution

Comprising evacuated tube and flat-plate solar collectors, circulation pump stations, and thermal storage units with heat exchangers:

- 12 × Westech SP-S58/1800A-20 EHPT evacuated tube collectors
- 5 × Alfa-Bit Beta 58/1800-12 evacuated tube collectors
- 10 × Tesy SP 07 250 ASL flat-plate collectors
- 3 × Taconova Tacosol Circ ZR high-efficiency pump stations
- 3 × Ferroli Ecounit 1000–2WB heat exchange and storage tanks

2 600 L solar thermal installation for Domestic Hot Water (DHW)

Thermosiphon systems with flat-plate collectors:

- 2 × SunSystem 300 L thermosiphon systems with flat-plate collectors.

3 32 kWp adsorption chiller system

- 2 × SorTech eCoo 2.0 adsorption chillers.

EXPERIMENTAL SOLAR-THERMAL PLATFORM ICSTM - ST

The ICSTM Solar-Thermal Platform enables research, testing, and demonstration of solar thermal technologies integrated with thermal energy storage systems (TESS), supporting energy efficiency, thermal comfort, and smart energy management.

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D PHOTOVOLTAIC CELLS TESTING. PRINTED CIRCUIT BOARDS PROTOTYPING. ELECTRICAL MEASURING

54 INTEGRATED SYSTEM FOR FLEXIBLE MANUFACTURING – IFMS_4.0_5.0



The Integrated Flexible Manufacturing System (IFMS_4.0_5.0) is an advanced research and higher education platform designed, implemented, and validated within the national research project PN-III-P1-1.2-PCCDI-2017-0290. From an architectural perspective, IFMS_4.0_5.0 is a fully automated system that reproduces, at laboratory scale, the complexity of a modern flexible production unit.

Designed according to the Cyber-Physical Systems (CPS) paradigm and integrating Industry 4.0 and Industry 5.0 concepts, the system incorporates two parallel flexible manufacturing flows: a linear flexible manufacturing flow (FFM, Flexible Flow Manufacturing) and a flexible manufacturing cell (FMC, Flexible Manufacturing Cell). To achieve these two parallel flows, the manufacturing system was designed with six interconnected workstations in a linear configuration, equipped with two industrial robotic manipulators, a disassembly station, a linear transport system fitted with an SCARA robot, and an autonomous Pioneer-type mobile robot.

This hardware configuration is controlled by a network of Siemens S7-1200 PLCs with Profinet communication, an RFID identification system designed to ensure product traceability, and HMI interfaces that enable the integration of the human operator at different points in the manufacturing process, thus applying Industry 5.0 concepts. The system enables the manufacture of five didactic typologies of multilayer products on the two parallel flows, with each product having a custom configuration.

The formal Digital Twin modelling of the system processes, carried out using Synchronised Petri Nets, enables the identification of critical congestion points, or bottlenecks, the balancing of production loads, and the accurate estimation of manufacturing times. This modelling made it possible to develop control algorithms for the precise positioning of products on the conveyor, as well as algorithms for optimal production planning across parallel flows.

Thus, this platform operationalises the fundamental concepts of Industry 4.0 and Industry 5.0: Smart Factory, IoT/IoE, Cloud Computing, and Digital Twin, ensuring: (i) operational resilience through automatic switching to alternative flows in the event of a failure; (ii) sustainability through the implementation of a complete assembly–disassembly–reuse cycle; and (iii) the reintegration of the human factor through HMI interaction and production customisation via client–server applications.



55 Business Analytics and Data-Driven Economic Insights



INFORMED DECISIONS | ADVANCED ANALYTICS | RELEVANT INSIGHTS | CUSTOMIZED SOLUTIONS

INTEGRATED ANALYTICS INFRASTRUCTURE

Our R&D infrastructure integrates advanced tools and platforms for collecting, processing, modeling, and interpreting economic and behavioral data. It enables rigorous analysis, supports strategic decision-making, and facilitates the development of innovative solutions for the business environment.

KEY FEATURES

- Professional applications widely used in research and business environments
- Intuitive interface for rapid data processing and report generation
- Support for descriptive, inferential, and predictive analytics
- Capability to handle large datasets
- Integration with survey data, Excel files, and external databases
- Data visualization through charts, tables, and dashboards.

TYPES OF ANALYSIS

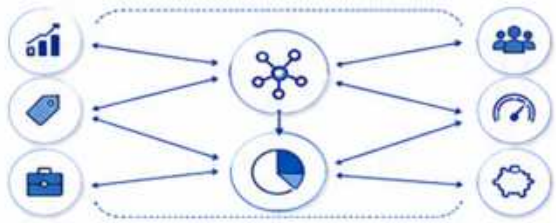
- Descriptive analysis (means, distributions, variability)
- Correlation and regression analysis (linear and multiple)
- Comparative analysis (ANOVA, t-tests)
- Segmentation and classification (cluster analysis)
- Factor analysis and dimensionality reduction.

TYPE OF DATA ANALYZED	FIELDS OF APPLICATION
• Survey and market research data	• Economics and Business Administration
• Economic and financial databases	• Marketing and Market Research
• Organizational performance indicators	• Financial Analysis and Management
• Consumer behavior data	• E-Commerce and Consumer Behavior
• Economic time series.	• Economic Policies and Socio-Economic Studies.

Descriptive and inferential statistical analysis, regression modelling, segmentation, and forecasting. Enables handling large datasets and generating professional reports.



Advanced modeling of causal relationships between economic and behavioral variables.





Power Query, Power Pivot for data processing and organization, exploratory analysis, and economic simulations.

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01 COMPLEX CHARACTERIZATION OF MICRO AND NANOMATERIALS

SEM-EDS/WDS advanced analysis for industrial diagnostics, materials engineering and applied research.

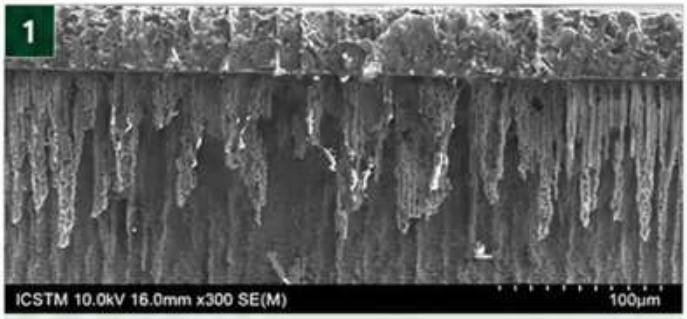
SERVICE CAPABILITIES

MORPHOLOGICAL ANALYSIS
Visualization of particle shape, material porosity, surface roughness or the way fibers are structured.

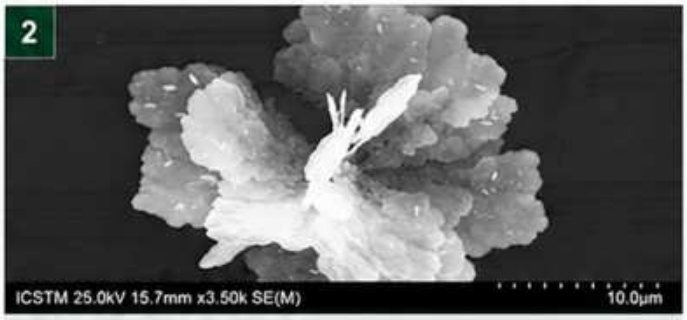
CHEMICAL MICROANALYSIS
Elemental chemical analysis at a point, on a line or on a chosen surface – particularly useful in identifying contaminants, checking the purity of an alloy, analyzing the geological composition, etc.

FRACTURE ANALYSIS (FRACTOGRAPHY)
Visualization of the fracture surface to determine whether it was a brittle, ductile fracture or caused by fatigue/corrosion with applications in metallurgy/steel industry, automotive/aeronautical industry, etc.

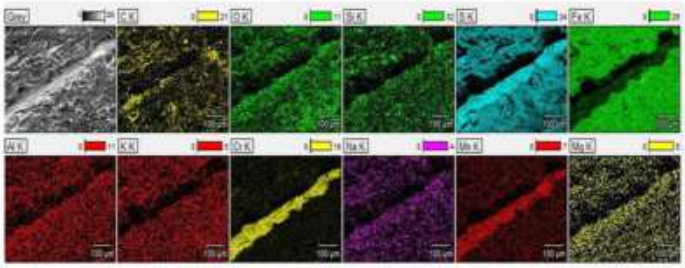
PRECISION MEASUREMENTS
Measuring the thickness of coating layers, the dimensions of micro and nanomaterials, the distances between integrated circuits, etc.



Surface fracture morphology



Nanostructured particle morphology



APPLICATION AREAS

The potential beneficiaries are companies and public institutions in the field of the following sectors of activity:

- nanotechnology
- metallurgy/steel industry
- semiconductors
- archaeometry
- photovoltaic systems
- environment
- biology
- food industry
- agriculture
- cosmetics
- chemical and petroleum industry, etc.

REQUIRED MATERIALS AND RESOURCES

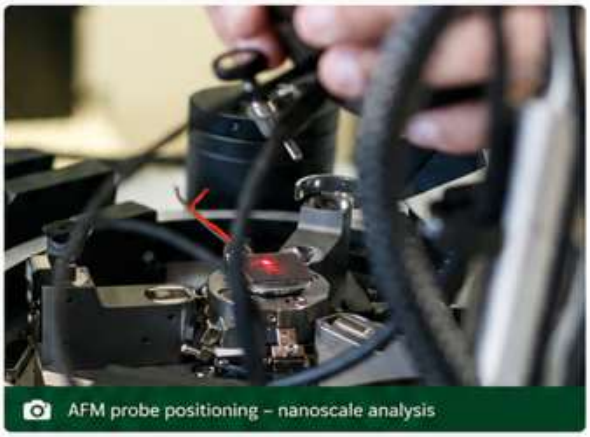
- scanning electron microscope coupled with dispersive X-ray spectrometers SEM-EDS/WDS
- electron source
- preliminary vacuum pump
- chiller
- oven.
- mortar and pestle/sample grinding mill
- spatulas
- sample holders
- fixing materials
- other auxiliary equipments/materials necessary for samples preparation.

02 CHARACTERIZATION OF MICRO AND NANOMATERIALS BY AFM

Advanced atomic force microscopy for high-resolution topography, nanoscale analysis and defect detection.



AFM measurement system – overview



AFM probe positioning – nanoscale analysis

SERVICE CAPABILITIES

2D & 3D TOPOGRAPHY OF MICRO AND NANOMATERIALS
Image visualization of particle shape, surface roughness.

CHARACTERIZATION OF NANOSCALE LAYER DEPOSITIONS (BY SPUTTERING, E-BEAM, ETC.)
Surface roughness, morphology of materials.

AFM DEFECTOSCOPY
Detection and analysis of surface defects at the nanoscale.

APPLICATION AREAS

The potential beneficiaries are companies and public institutions in the field of the following sectors of activity:

- nanotechnology
- metallurgy/steel industry
- semiconductors
- photovoltaic systems

REQUIRED MATERIALS AND RESOURCES

- atomic force microscope (AFM)
- AFM probes
- isopropyl alcohol
- mica discs
- double-sided tape
- other auxiliary equipments/materials necessary for samples preparation.

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03 OPTICAL CHARACTERIZATION OF MATERIALS

High-resolution optical microscopy for surface analysis, quality assessment and applied research.



Optical microscope – sample observation



Optical inspection – surface microstructure analysis

SERVICE CAPABILITIES

DEFECTOSCOPY BY BRIGHT FIELD OPTICAL MICROSCOPY (optional by reflected light) and optical characterization of surface microstructures (texture, inclusions, deposits, impurities).

CONTROL QUALITY ASSESSMENT
Evaluation of manufacturing processes of various materials by inspecting surfaces for imperfections using real-time image acquisition and ensure products meet required standards.

STUDY OF THE ARTEFACTS AND ARCHAEOLOGICAL SAMPLES
Optical analysis and documentation of artefacts and archaeological materials.

ENVIRONMENTAL STUDY
Microscopic analysis of environmental samples (soil, vegetals, water, etc.).

APPLICATION AREAS

The potential beneficiaries are companies and public institutions in the field of the following sectors of activity:

- microtechnology
- metallurgy/steel industry
- semiconductors
- photovoltaic systems
- environment
- archaeology
- food science
- earth science, etc.

REQUIRED MATERIALS AND RESOURCES

- optical microscope
- glass slides
- isopropyl alcohol
- immersion oil
- fixing materials
- tweezers, bistoury, spatula
- other auxiliary equipments/ materials necessary for samples preparation.

04 EVALUATION OF THE CRYSTALLINE STRUCTURE AND PHASE COMPOSITION OF SOLID AND POWDERED MATERIALS BY X-RAY DIFFRACTION (XRD) TECHNIQUE TO CHARACTERIZE AND OPTIMIZE THEIR PROPERTIES

This CDI service consists of the analysis of the crystal structure and phase composition of solid and powdered materials using X-ray diffraction (XRD) technique. The study enables the identification and characterization of crystalline and amorphous phases in a wide range of materials, including rocks, minerals, industrial products, ceramic materials, metals and alloys, as well as archaeological artefacts. The results obtained provide essential information for material characterization, understanding structural transformations, and optimizing their properties in industrial, scientific, and heritage conservation contexts.



Sample preparation for analysis



Material sampling and preparation

APPLICATION AREAS

The potential beneficiaries are companies and public institutions in the field of the following sectors of activity:

- construction materials industry
- metallurgical and manufacturing industries
- chemical and petrochemical industries
- ceramic and advanced materials industries
- producers and processors of mineral raw materials
- producers of fuels, auxiliary materials, and intermediate products
- industrial quality control and in-house certification laboratories
- institutes and applied research centers in materials science, geochemistry, and chemical engineering
- archaeological laboratories and research teams (analysis of ceramics, pigments, rocks, and historical materials)
- universities and academic centers with technical and scientific profiles
- national research and development institutes
- museums, cultural heritage centers, and conservation institutions
- regulatory authorities and institutions in the field of material quality and heritage protection
- broader economic environment, through improved product quality and increased efficiency of technological processes.

REQUIRED MATERIALS AND RESOURCES

Required materials and resources:

- X-ray diffractometer (XRD) ultima IV
- ICDD PDF-5+ database
- XRD data acquisition and processing system
- sample holders (for powder and solid samples)
- crystalline reference standards (CRM) for calibration and method validation (e.g., Si, etc.)
- special sample holders (glass, Si, zero-background)
- sample preparation materials (laboratory mill, mortar)
- general laboratory consumables (spatulas, tweezers, weighing paper, sample containers).

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05 EVALUATION OF THE ELEMENTAL AND OXIDE COMPOSITION OF SOLID, LIQUID AND POWDERED MATERIALS BY WDXRF TECHNIQUE FOR OPTIMIZING THEIR USE IN TECHNOLOGICAL PROCESSES

This service consists of determining the chemical composition of a wide range of materials, including solids, liquids, and powders, using wavelength-dispersive X-ray fluorescence (WDXRF) technique. The method enables rapid and accurate identification and quantification of major, minor, and trace elements, as well as their corresponding oxides, providing essential information for material characterization and for assessing their behavior in technological processes.

The obtained results are used to optimize material utilization in industrial applications by adjusting composition, improving quality, and increasing the efficiency of manufacturing processes. The service supports both quality control activities and the development and refinement of material processing technologies.



Autosampler with 12 positions



WDXRF spectrometer Supermini200 - overview

SERVICE CAPABILITIES

CHEMICAL COMPOSITION DETERMINATION
Determination of major, minor and trace elements and their corresponding oxides in solids, liquids and powders using WDXRF technique.

RAPID AND ACCURATE ANALYSIS
High accuracy, wide dynamic range and excellent sensitivity for reliable results.

MATERIAL CHARACTERIZATION
Essential information for understanding the composition and behavior of materials in technological processes.

PROCESS OPTIMIZATION
Optimization of material utilization by adjusting composition, improving quality and increasing process efficiency.

QUALITY CONTROL & R&D SUPPORT
Supports quality control activities and the development and refinement of processing technologies.

APPLICATION AREAS

The potential beneficiaries are companies and public institutions in the field of the following sectors of activity:

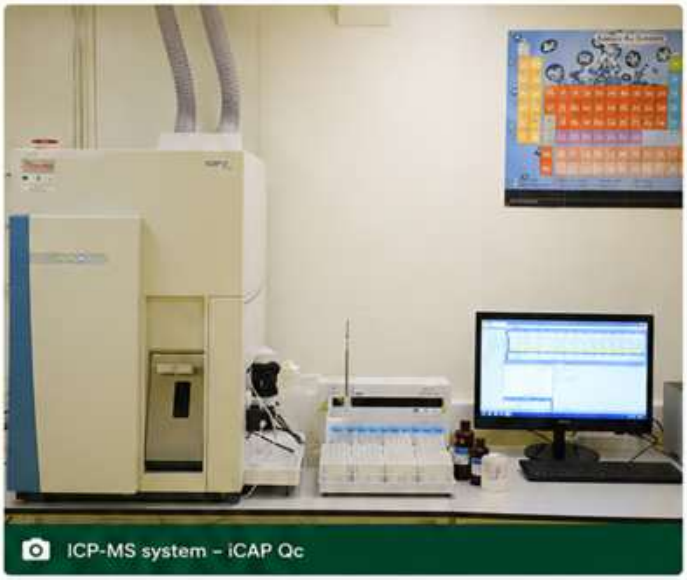
- construction materials industry
- metallurgical and manufacturing industries
- chemical and petrochemical industries
- ceramic and advanced materials industries
- producers and processors of mineral raw materials
- producers of fuels, auxiliary materials, and intermediate products
- industrial quality control and in-house certification laboratories
- institutes and applied research centers in materials science, geochemistry, and chemical engineering
- archaeological laboratories and research teams (analysis of ceramics, pigments, rocks, and historical materials)
- universities and academic centers with technical and scientific profiles
- national research and development institutes
- museums, cultural heritage centers and conservation institutions
- regulatory authorities and institutions in the field of material quality and heritage protection
- broader economic environment, through improved product quality and increased efficiency of technological processes.

REQUIRED MATERIALS AND RESOURCES

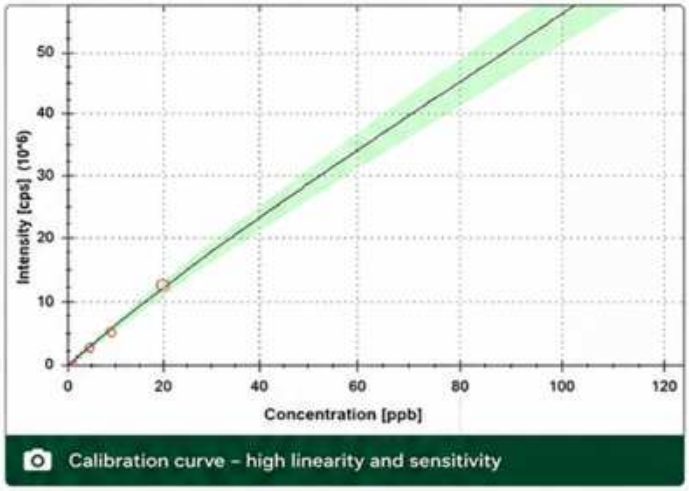
- wavelength-dispersive X-ray fluorescence spectrometer (WDXRF) Supermini200
- vibratory disc mill Testchem (stainless steel and tungsten grinding vessels)
- manual press 250 kN Testchem (for pellet preparation)
- analytical balance
- drying oven for sample preparation
- desiccator for cooling and stabilizing samples
- P10 calibration gas cylinder
- helium (He) gas cylinder
- powder binder (Boreox)
- 6 µm Mylar film
- Certified Reference Materials (CRM) for calibration and method validation
- General laboratory consumables (containers, spatulas, weighing paper, sample handling tools)

06 ELEMENTAL CONTENT ASSESSMENT BY ICP-MS

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for ultra-trace elemental analysis with high accuracy, sensitivity and wide dynamic range.



ICP-MS system – iCAP Qc



Calibration curve – high linearity and sensitivity

SERVICE CAPABILITIES

ENVIRONMENTAL ANALYSIS

- Water quality analysis (drinking water, wastewater, surface or groundwater – for the detection of heavy metals and pollutants)
- Soil and sediment analysis (determination of geochemical composition and level of metal contamination)
- Vegetals and particulate matter (PM collected on filters) for the detection of heavy metals

FOOD AND COSMETIC ANALYSIS

- Food safety (identification of heavy metals in food, beverages, and agricultural products)
- Cosmetics (testing for metal impurities)

INDUSTRIAL AND MATERIALS ANALYSIS

- Determination of trace metals in chemical products, high purity materials, alloys or polymers.

APPLICATION AREAS

The potential beneficiaries are companies and public institutions in the field of the following sectors of activity:

- environment (i.e., water, soil, or vegetal samples)
- food industry
- agriculture
- metallurgy/steel industry
- semiconductors
- cosmetics, etc.

REQUIRED MATERIALS AND RESOURCES

- ICP-MS spectrometer – iCAP Qc
- TOPwave® digester
- Polytetrafluoroethylene (PTFE) vials, PTFE caps, metal rupture discs, volumetric flasks (borosilicate glass), and autosampler tubes
- Mortar and pestle/sample grinding mill
- Sieve
- Argon 3.5 and helium 5.0
- Mineralization reagents – depending on the sample matrix
- Standard materials for calibration and method verification
- Other auxiliary equipment and materials required for sample preparation.

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07 EVALUATION OF CHEMICAL COMPOSITION THROUGH ATR-FTIR SPECTROSCOPY

ATR-FTIR spectroscopy enables rapid and accurate identification and quantitative analysis of a wide range of materials, providing reliable information on chemical composition and contaminants.

SERVICE CAPABILITIES

MATERIAL IDENTIFICATION
Identifies plastics, rubbers, chemical compounds, polymers, and contaminants.

CONTAMINANT DETECTION
Used for troubleshooting and failure analysis when materials do not meet specifications.

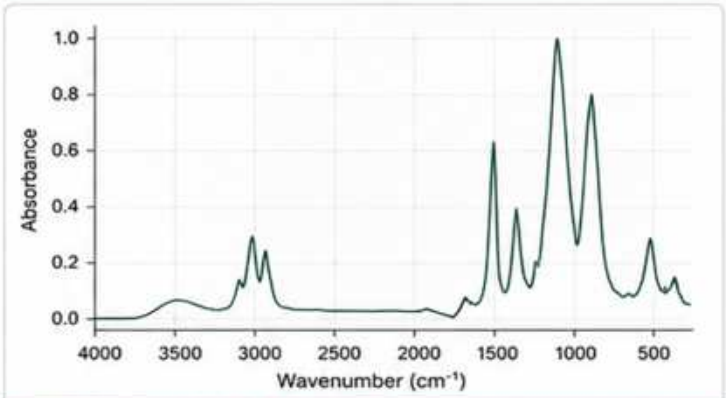
QUANTITATIVE ANALYSIS
Determines the concentration of components in complex mixtures.

SAMPLING TECHNIQUES
Diamond Attenuated Total Reflectance (ATR) for solids/liquids, allowing for minimal sample preparation.

RAPID ANALYSIS
Provides quick results that are interpreted and presented, often including spectral comparisons to databases.



ATR module with diamond crystal – sample analysis



FTIR spectrum – material fingerprint

APPLICATION AREAS

- electronics & semiconductors
- chemical/pharmaceutical
- materials & manufacturing
- environment & forensics
- food industry & agriculture
- metallurgy/steel industry
- art & heritage
- cosmetics, etc.

REQUIRED MATERIALS AND RESOURCES

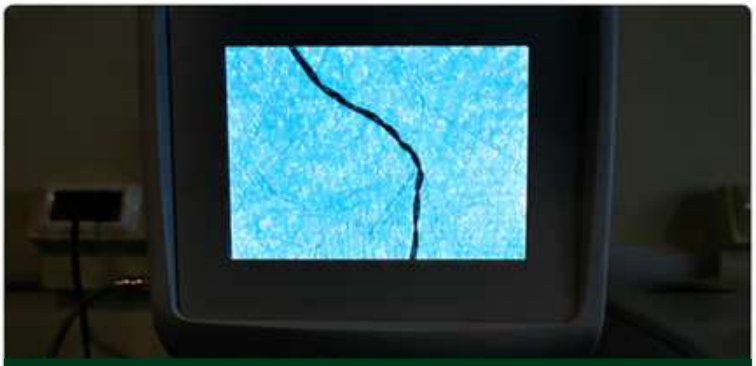
- Vertex 80v spectrometer coupled with ATR module
- mortar and pestle / sample grinding mill
- sieve
- standard materials for calibration and method verification
- other auxiliary equipments/materials necessary for samples preparation
- OPUS library

08 MICROPLASTICS CONTENT ASSESSMENT – IDENTIFICATION, QUANTIFICATION, AND CHARACTERIZATION OF MICROPLASTICS

This service provides comprehensive analysis of microplastics in a wide range of environmental, food, and cosmetic samples, enabling reliable identification, quantification, and characterization of microplastic particles.



Vertex 80v spectrometer coupled with IR hyperion2000 microscope



Optical microscope - particle observation and selection

SERVICE CAPABILITIES

ENVIRONMENTAL ANALYSIS

- Microplastics in water (drinking water, wastewater, surface or groundwater)
- Soil, sediment, and vegetals

FOOD AND COSMETICS STUDY

- Microplastics in milk and dairy products, beverages, salt, honey, tea
- Cosmetics and personal care products (soaps, creams, lotions, gels, toothpastes, etc.)

IDENTIFICATION & CHARACTERIZATION

- Morphological and spectroscopic identification of microplastic particles
- Quantification and characterization based on size, shape, and polymer type.

POTENTIAL BENEFICIARIES

- Environment (water, soil, or vegetal samples)
- Food industry
- Agriculture
- Cosmetics

REQUIRED MATERIALS AND RESOURCES

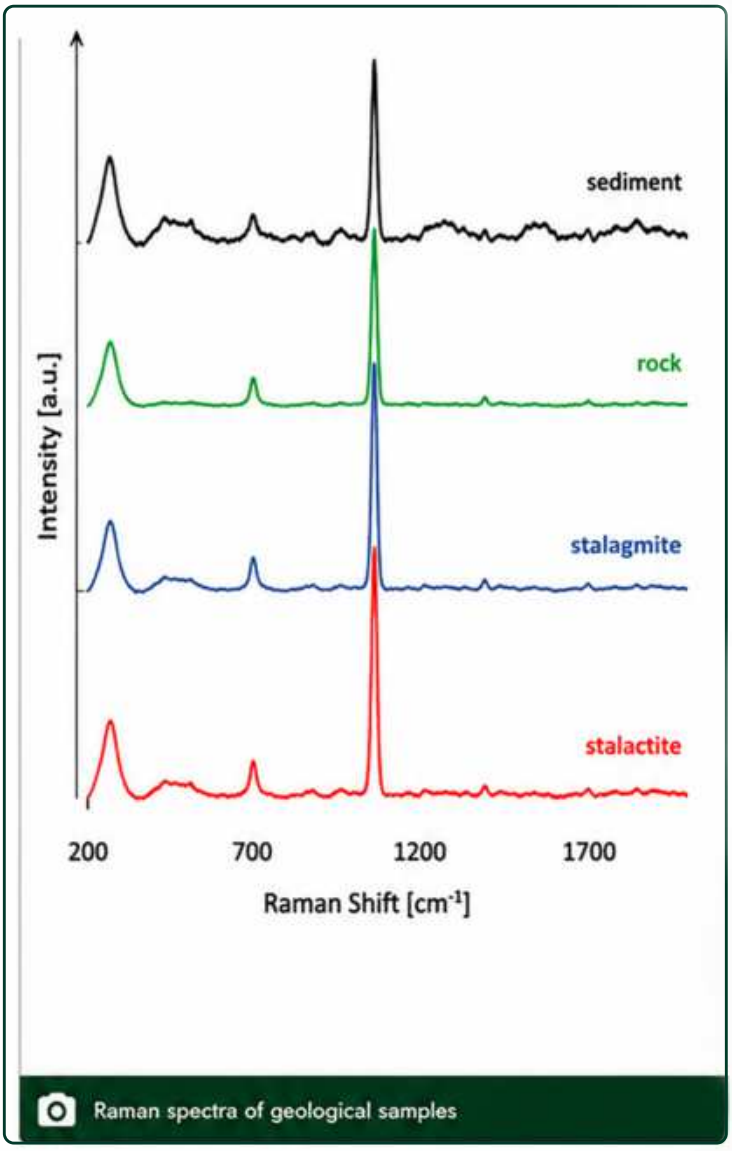
- Vertex 80v spectrometer coupled with IR Hyperion 2000 microscope
- Optical microscope (existing) with external light source
- Mortar and pestle / sample grinding mill
- Sieve
- Liquid nitrogen 5.0
- Mineralization reagents – depending on the sample matrix
- Standard materials for calibration and method verification
- Other auxiliary equipments/materials necessary for samples preparation.

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09 EVALUATION OF CHEMICAL COMPOSITION THROUGH RAMAN SPECTROSCOPY

Raman spectroscopy provides rapid, non-destructive identification and detailed characterization of materials by analyzing their molecular vibrations.

It is a powerful tool for qualitative and quantitative analysis in research and industrial applications.



Raman spectra of geological samples

SERVICE CAPABILITIES

MATERIAL IDENTIFICATION & CHARACTERIZATION
Identifies unknown solid or liquid substances by analyzing inelastically scattered light, revealing vibrational modes that define their chemical structure.

PHARMACEUTICAL ANALYSIS
Identifies polymorphs, detects raw material impurities, and checks for counterfeit drugs, even through sealed, transparent packaging.

REACTION MONITORING
Enables real-time tracking of chemical reactions to identify intermediate species and optimize process conditions without interrupting the workflow.

CULTURAL HERITAGE & ART CONSERVATION
Offers non-invasive analysis of pigments, polymers, and degradation products in artworks and artifacts to determine authenticity and guide conservation.

APPLICATION AREAS

- electronics & semiconductors
- chemical/pharmaceutical
- materials & manufacturing
- environment & forensics
- food industry & agriculture
- metallurgy/steel industry
- art & heritage
- cosmetics, etc.

REQUIRED MATERIALS AND RESOURCES

- Xantus 2 spectrometer
- Mortar and pestle / sample grinding mill
- Sieve
- Standard materials for calibration and method verification
- Other auxiliary equipments/materials necessary for samples preparation
- Internal library
- Liquid vials.

10 EVALUATION OF WATER / MOISTURE CONTENT IN LIQUID AND SOLID SAMPLES FOR MATERIAL STABILITY AND PROCESSES OPTIMIZATION



Karl Fischer Coulometric Titrator C20

Karl Fischer Coulometric Titration C20 is applied to determine trace moisture content in a wide range of samples where high analytical accuracy is required. The results provide valuable insights into material quality, storage conditions, and critical process parameters, supporting effective manufacturing control and ensuring sample stability (e.g. pharmaceutical products, food materials, mineral oils used in electrical equipment, etc.). Accurate water control is essential in different industries to prevent degradation and unwanted side reactions, while maintaining performance, safety, as well as compliance with technical standards. The method is applicable to a broad variety of samples, including oils, fuels, solvents, polymers, pharmaceuticals, chemicals, and other liquid or solid materials.

Alternatively, thermobalance is the techniques of choice for samples with higher moisture content. Moisture content is determined through controlled heating and continuous mass measurement, enabling rapid and reliable results that may be used for processes optimization.

This study may provide valuable information supporting improving the shelf life, safety, and processing efficiency (i.e. agri food), ensuring product stability, regulatory compliance, and consistent performance of moisture sensitive ingredients and finished products (i.e. pharmaceutical, biotechnology, and life sciences industries), prevention of risks, equipment degradation and performance losses (i.e. energy, electrical, petrochemical, oil sectors), process optimization, raw material qualification, and innovation (i.e. advanced composite materials).



SERVICE CAPABILITIES

KARL FISCHER COULOMETRIC TITRATION

- Trace moisture determination with high accuracy and sensitivity;
- Suitable for liquids and solids;
- Wide applicability: oils, fuels, solvents, polymers, pharmaceuticals, chemicals, and more.

THERMOBALANCE (HALOGEN MOISTURE ANALYZER)

- Ideal for samples with higher moisture content;
- Controlled heating and continuous mass measurement;
- Fast and reliable results for process optimization.

POTENTIAL BENEFICIARIES

- Pharmaceutical, biotechnology, and life sciences industries
- Food, feed, and agricultural product manufacturers
- Energy, electrical, petrochemical, and oil sectors
- Companies in the chemical, polymer, plastics, and materials industries, as well as industrial R&D units and testing laboratories.

REQUIRED MATERIALS AND RESOURCES

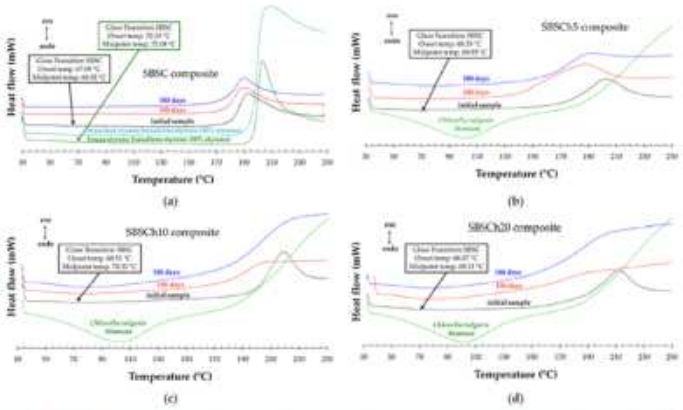
- Karl Fischer coulometric titrator C20
- Analytical balance
- Halogen moisture analyzer

CONSUMABLES AND AUXILIARY MATERIALS

- Specific chemical substances reagents (solvents, reagent), etc.;
- Various sample preparation accessories and instruments (e.g., mortars, others, according to sample type);
- Certified reference materials.

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11 STUDY OF GLASS TRANSITION PHENOMENA IN ADVANCED POLYMERIC AND COMPOSITE MATERIALS FOR PERFORMANCE OPTIMIZATION AND PROCESSING CONTROL



Differential Scanning Calorimetry (DSC) technique is used to study glass transition phenomena in advanced polymeric and composite materials, enabling the determination of key thermal properties for performance optimization and processing control. The method is suitable for a wide range of solid samples, including thermoplastic and thermoset polymers, elastomers, polymer blends, and composite materials with fillers or bio-based components.

For industrial companies, this service provides actionable insights for material selection, quality control, and product development, helping to reduce development time, optimize processing conditions, and enhance product reliability.

KEY BENEFITS

- **Optimize material performance**
- **Improve processing efficiency**
- **Reduce development time**
- **Ensure quality and reliability**
- **Support innovation with advanced and sustainable materials**

SERVICE CAPABILITIES

GLASS TRANSITION ANALYSIS

• Determines glass transition temperature (Tg) and related thermal events (e.g., enthalpy relaxation) in polymers and composites.

MATERIAL CHARACTERIZATION

• Provides key thermal properties (Tg, melting temperature, crystallinity, heat capacity, specific heat) for material selection and performance evaluation.

PROCESS OPTIMIZATION & QUALITY CONTROL

• Supports optimization of processing conditions, ensures consistent product quality, and improves reliability.

REQUIRED MATERIALS AND RESOURCES

- Differential Scanning Calorimeter (DSC)
- Dedicated PC
- STARe software for data acquisition and analysis
- Analytical balance
- Sample preparation accessories (e.g., tweezers, sealing press)
- Crucibles (to be selected according to sample type)
- Reference standards.

POTENTIAL BENEFICIARIES

Production and processing of polymeric and composite materials
Automotive
Aerospace
Electrics
Electronics
Packaging
Construction
Companies developing advanced materials (including bio-based and sustainable polymers)

12 EVALUATION OF CARBON AND SULFUR CONTENT IN SOLID SAMPLES BY MULTI EA 4000

The Multi EA 4000 analyzer is a powerful elemental analyzer designed for the accurate determination of carbon (C) and sulfur (S) content in solid samples.

The method ensures high precision, reliability, and compliance with international standards, supporting quality control, process optimization, and environmental monitoring.



Multi EA 4000 elemental analyzer


Sample boat (ceramic nacelle) in the autosampler

SERVICE CAPABILITIES

ENVIRONMENTAL ANALYSIS

Soil and vegetal analysis (determination of carbon and/or sulfur) on dried sample.

FOOD SAFETY

Control of preservatives in dried fruits, pickled vegetables, meat products.

INDUSTRIAL ANALYSIS

Evaluation of combustion efficiency and the quality of the resulting ash, especially for fly ash from thermal power plants.

POTENTIAL BENEFICIARIES

- Environment (i.e., soil and/or vegetal samples)
- Food industry
- Agriculture
- Building materials industry

REQUIRED MATERIALS AND RESOURCES

- Multi EA4000 analyzer
- Ceramic nacelles/boats
- Oxygen 5.0
- Oven
- Mortar and pestle / sample grinding mill
- Precision balance
- Sieve
- Magnesium perchlorate
- Standard materials for calibration and method verification
- Other auxiliary equipments/materials necessary for samples preparation.

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13 DETERMINATION OF PHYSICOCHEMICAL PARAMETERS IN DRINKING WATER, WASTEWATER, GROUNDWATER OR SURFACE WATER BY ELECTROCHEMICAL METHODS

(MULTIPARAMETER WTW INOLAB_IDS MULTI 9430)

This service consists of high-performance multiparameter benchtop meters designed to measure a suite of electrochemical and physical water quality parameters simultaneously.



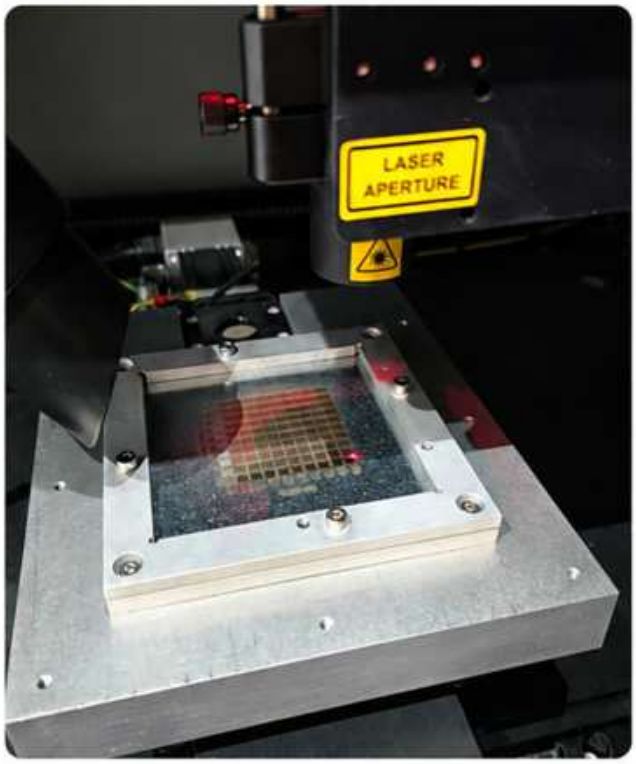
POTENTIAL BENEFICIARIES

- Environment (i.e., water, soil, or vegetal samples)
- Food industry
- Agriculture
- Metallurgy/steel industry
- Semiconductors
- Cosmetics
- Chemical and petroleum industry
- etc.

REQUIRED MATERIALS AND RESOURCES

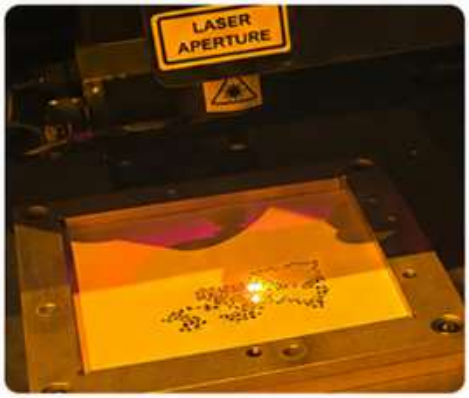
- Multiparameter WTW Inolab_IDS Multi 9430
- Standard materials for calibration and method verification
- Electrodes
- Other auxiliary equipments/materials necessary for samples preparation.

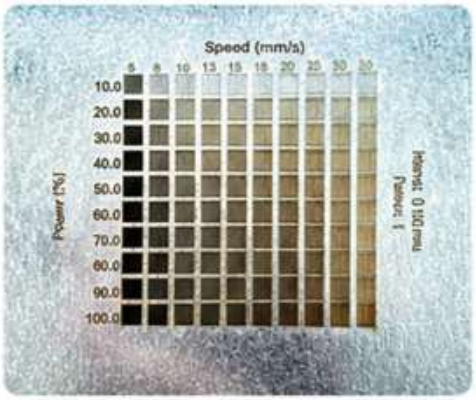
14 LASER MICROMACHINING, DRILLING, AND SURFACE PROCESSING SERVICES USING AN OXFORD LASERS MICRO-MACHINING SYSTEM

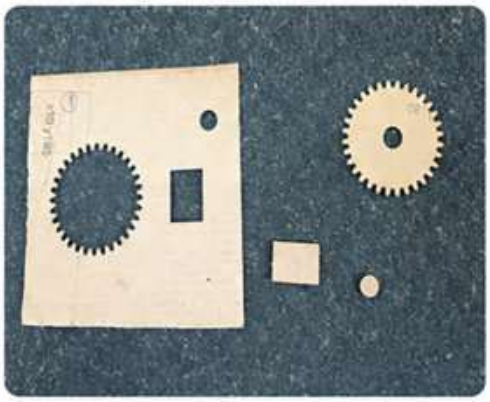


This service provides high-precision laser-based material processing using an Oxford Lasers Micro-Machining System. The available operations include laser micromachining and micro-cutting of a wide range of materials (metals, ceramics, polymers, composites), laser drilling and perforation for the creation of micro-holes and through-features with controlled geometry, and laser surface texturing and ablation for surface functionalization, cleaning, or selective material removal. Samples are processed under computer-controlled motion with micrometric accuracy.

The service covers feasibility testing, parametric optimization, and small-to-medium batch processing. Results are provided as processed specimens together with dimensional and surface quality reports where applicable.







POTENTIAL BENEFICIARIES

- Automotive
- Aerospace
- Defence
- Electronics
- Microelectronics
- Energy
- Advanced materials
- Prototype and feasibility studies for small and medium batch processing

REQUIRED MATERIALS AND RESOURCES

- Oxford Lasers micro-machining system
- Pulsed laser source
- Computer-controlled multi-axis precision motion stage
- Other auxiliary equipments/materials.

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15 MECHANICAL TESTING



The alignment equipment is calibrated in accordance with MTS Calibration Procedure 7348.
The specific work procedures cover the direct determination of material properties: the modulus of elasticity and the characteristic curve of materials.
The MTS – Bionix Series 370 Mechanical Testing System is equipped with four subsystems:

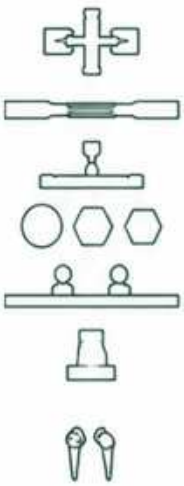
- a tension subsystemt with a force capacity of up to 30 kN, compatible with flat and round specimen profiles
- a bending subsystem with a force capacity of up to 10 kN
- a compression subsystem – a Ø 60 compression platen, with a force capacity of up to 100 kN
- a hip implant testing subsystem for determining material properties in terms of tribological behavior.

POTENTIAL BENEFICIARIES

- Automotive
- Metallurgical
- Electronics
- Materials
- Quality control and material certification laboratories

REQUIRED MATERIALS AND RESOURCES

- Tension subsystem
- Specimen
- Bending subsystem
- Round or polygonal cross-sections
- Roller fixtures (10 mm rollers)
- Compression subsystem
- Testing subsystem



16 DETERMINING MECHANICAL PROPERTIE

Knowing the mechanical properties of materials enables the optimal selection thereof with a view to increasing the durability of components (engines, gearboxes, injectors, etc.), thus reducing maintenance costs.

It also aids in testing innovative new materials with extensive industrial applications, ensuring increased product safety, wear reduction, and extending the lifespan of facilities/products.

It allows the quick validation of new materials and their optimization through structure-property correlation.



POTENTIAL BENEFICIARIES

- Materials and new materials
- Invite team members
- Nanotechnology
- Quality control and material certification laboratories

REQUIRED MATERIALS AND RESOURCES

- G200 Nanoindenter
- Consumables – crystal bond thermoplastic polymer
- Berkovich indentation tip calibrated
- Sample holder.

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17 3D CAD DESIGN

Creation of parametric 3D models – this service ensures the development of precise models, compatible with manufacturing standards and ready for analysis, simulation and rapid prototyping.





POTENTIAL BENEFICIARIES

- Automotive
- Aeronautics
- Industrial equipment
- Metal construction
- Mechanical design
- Innovative products

REQUIRED MATERIALS AND RESOURCES

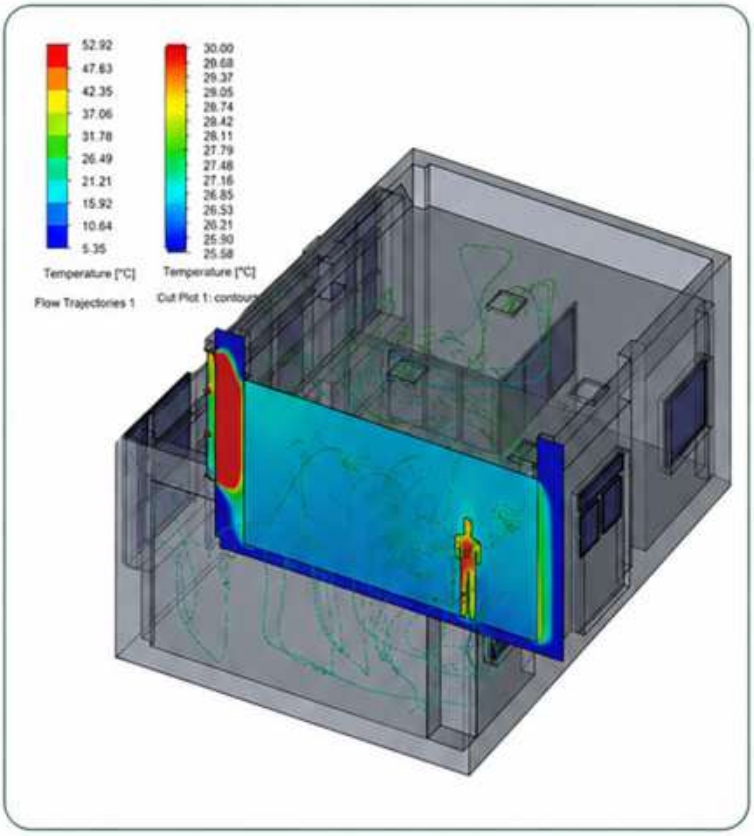
High-performance graphics workstations
CAD, simulation, and Flow Simulation licenses

3D printer or CNC for prototype validation
3D scanner for reverse engineering (optional, if modeling existing parts)
Consumables for prototyping: PLA/ABS filament, resin, test materials
Other additional software, if advanced validation is required
Support infrastructure: workspace with assembly benches, measuring instruments (probe, micrometer, digital caliper).

18 ADVANCED SIMULATION AND NUMERICAL ANALYSIS

Advanced simulation and numerical analysis to optimize 3D models before production.





POTENTIAL BENEFICIARIES

- Automotive
- Aeronautical
- Defense
- Industrial equipment
- Metal constructions
- Energy
- Research institutions and universities with a technical profile

REQUIRED MATERIALS AND RESOURCES

- High-performance graphics workstations
- CAD, simulation, and Flow Simulation licenses
- 3D printer or CNC for prototype validation
- 3D scanner for reverse engineering (optional, if modeling existing parts)
- Consumables for prototyping: PLA/ABS filament, resin, test materials
- Other additional software – if advanced validation is required
- Support infrastructure: workspace with assembly benches, measuring instruments (probe, micrometer, digital caliper).

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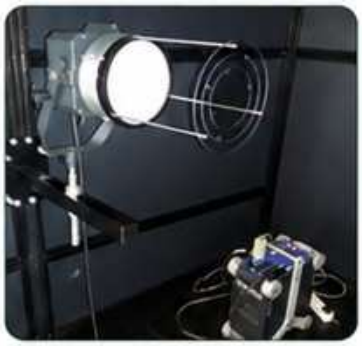
19 PHOTOVOLTAIC MODULE TESTING SERVICES USING QUICKSUN 700A SOLAR SIMULATOR

By using the QuickSun 700A Solar Simulator, we provide reliable electrical characterization, enabling clients to validate module performance, detect defects, and ensure compliance with international standards. This service supports quality assurance and performance optimization of PV investments.

This service is essential for manufacturers, installers, and investors who require certified verification of PV module quality and efficiency. The system uses a xenon flash lamp filtered to meet Class A spectral standards, ensuring that measurements closely replicate real sunlight conditions. With excellent irradiance uniformity of better than ± 2%, the simulator guarantees consistent and repeatable test results. Its robust flash head, powered by a 6000 Ws generator, supports intensive testing campaigns, with a lamp lifetime exceeding 40,000 flashes. Our testing service accommodates different module sizes and throughput requirements. For larger modules, a test area of 160 × 220 cm allows up to 60 measurements per hour, while a more compact configuration of 130 × 160 cm enables high-throughput testing of up to 120 measurements per hour. These flexible configurations ensure both accuracy and efficiency, depending on project needs.







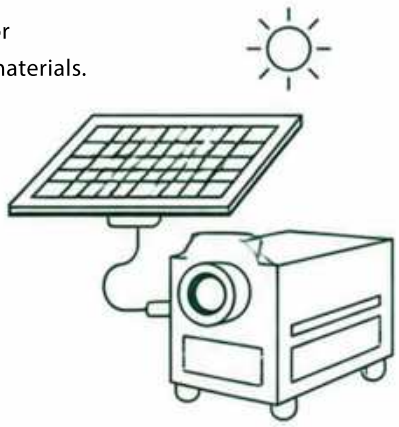


POTENTIAL BENEFICIARIES

- PV module manufacturers
- EPC (Engineering, Procurement, and Construction) contractors
- Solar project developers and investors
- Quality assurance & third-party inspection firms
- Solar park owners and operators
- PV distributors and wholesalers
- Insurance companies
- Research institutes and universities.

REQUIRED MATERIALS AND RESOURCES

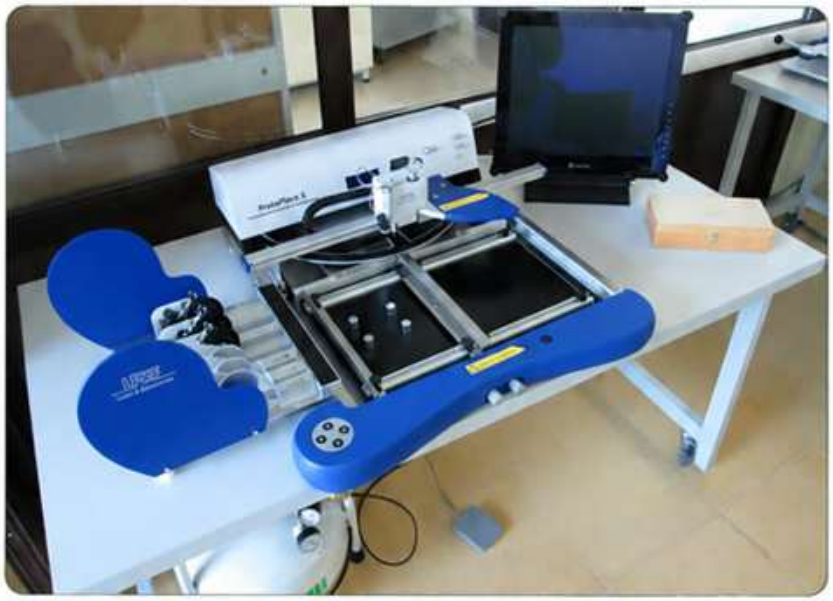
- QuickSun 700A solar simulator
- Other auxiliary equipments/materials.



20 SMD CIRCUIT BOARD PROCESSING

A six stage process is required for creating a electronic circuit after the PCB is manufactured:

1. Preparing the PCB for processing (cleaning),
2. Applying solder paste on the SMD component pads,
3. Applying the SMD components on the component pads,
4. Fixing the SMD components on the PCB using thermal treatment,
5. Inspecting and cleaning the resulted electronic circuit,
6. Testing the electronic circuit functionality with specific instruments.



POTENTIAL BENEFICIARIES

- Automotive
- General electronics
- Household devices
- Medical devices
- Military devices
- IT&C devices

REQUIRED MATERIALS AND RESOURCES

- ProtoPlace S
- ProtoFlow S
- Constant pressure line (> 5 bar)
- Special solder paste (various viscosity and type of solder material)
- Special flux (various viscosity and type of flux material)
- Vacuumatic desolder pump
- Professional temperature adjustable soldering/desoldering iron
- Special syringe
- Special syringe heads
- Custom thermocouples
- High temperature sticking pads
- High temperature precision gloves
- PCB cleaning spray

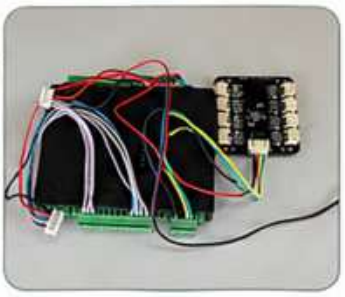


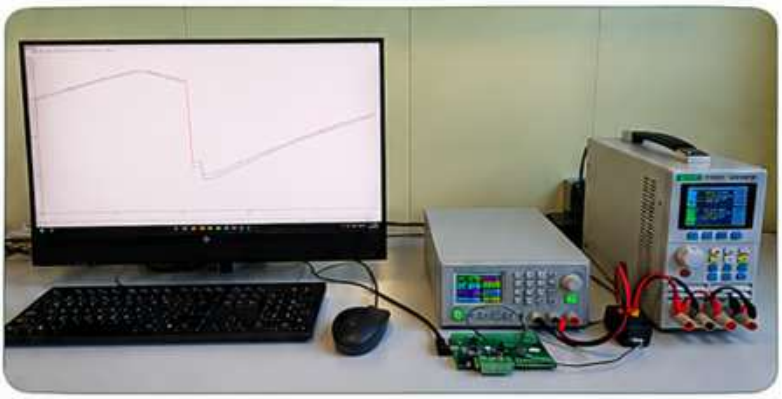
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21 INTEGRATED STUDY ON PCB DESIGN, 3D MODELING OF ELECTRONIC ASSEMBLIES, AND FUNCTIONAL VALIDATION OF ELECTRONIC CIRCUITS









This service focuses on the design, development, and validation of electronic circuits through advanced PCB design techniques, 3D modeling of assemblies, and functional testing of prototypes. The process includes schematic design and PCB layout using specialized EDA software, spatial validation through 3D CAD modeling of the electronic assembly within its enclosure, and rapid prototyping using PCB fabrication technologies.

Functional validation is performed using dedicated electronic testing equipment, such as oscilloscopes, programmable power supplies, signal generators, and logic analyzers. The service supports the development of reliable and optimized electronic systems, ensuring compliance with functional and spatial requirements while reducing development time and prototyping costs.

POTENTIAL BENEFICIARIES

- Innovative electronic products
- IoT solution providers and system integrators
- Embedded systems
- Intelligent devices
- Rapid prototyping and product development
- Automotive electronics
- Electronics industrial

REQUIRED MATERIALS AND RESOURCES

- Performance workstations equipped with EDA (Electronic Design Automation) software for schematic design and PCB layout
- 3D CAD software for modeling and spatial validation of electronic assemblies
- Oscilloscopes
- Programmable power supplies
- Electronic load
- Signal generators
- Logic analyzers
- PCB materials (FR4 boards)
- Electronic components (integrated circuits, connectors, passive components, microcontrollers)
- Assembly materials (solder paste, flux, soldering tools)
- Prototype enclosures (for integration and validation)
- Cables and interconnection accessories

22 CUSTOM EMBEDDED ELECTRONIC PROTOTYPES



The electronic prototype represents a intermediary step towards a final electronic device that has specific functions. These prototypes help in the assessment of the future finished electronic devices, by means off testing, measurements, improvements using hardware upgrades or firmware updates, and general behaviour towards achieving its dedicated functions.

There are five phases in creating and testing a prototype:

1. The general idea on the electronic circuit functionality and design;
2. The PCB circuit CAD design;
3. The CNC processing of the PCB;
4. The components soldering on the PCB;
5. The testing of the electronic circuit prototype.

Perf boards can also be used to accelerate prototyping and cutting the steps in creating one. This method reduces time, effort, consumables and overall costs.



POTENTIAL BENEFICIARIES

- Automotive
- General electronics manufacturing
- Household devices
- Medical devices
- Military devices
- IT&C devices

REQUIRED MATERIALS AND RESOURCES

- protomat S 103
- vacuum unit
- constant pressure line (~10 bar)
- professional temperature adjustable soldering/desoldering working station
- mill and drill bits
- dedicated PCB machining sintered bed material
- special adhesive tape
- medical grade vacuum and HEPA filters
- dedicated machining tools
- dedicated machining consumables
- solder wire
- solder resin and flux
- PCB spray cleaning agents
- dedicated electronics aiding tools
- other dedicated electronics consumables.

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23 RDI SERVICES FOR PROCESSES, PRODUCTS, AND TECHNOLOGIES IN RENEWABLE ENERGY CONVERSION

OBJECTIVE

This service delivers applied research, development, and innovation (RDI) support for companies seeking to develop or improve technologies related to renewable energy conversion. It targets industrial firms, technology developers, and startups that require scientific expertise to move from concept to market-ready solutions.

The institute collaborates with clients to design, test, and refine new processes, products, or technological solutions - such as advanced photovoltaic materials, energy conversion systems, or hybrid energy platforms. Activities may include experimental research, prototype development, performance validation, and scaling support.

A strong emphasis is placed on practical applicability and technology readiness level (TRL) advancement, ensuring that research outputs are aligned with industrial needs. The institute can also support intellectual property generation and integration into commercial products.

This service enables companies to access high-level scientific capabilities without building internal R&D infrastructure, accelerating innovation while reducing cost and technical uncertainty.



MANAGEMENT LOGIC

We combine advanced infrastructure with multidisciplinary expertise to transform ideas and research into applicable solutions, with a high Technology Readiness Level (TRL). We work closely with beneficiaries to understand industrial needs, reduce technological risks, and accelerate the integration of innovation into products and processes.



TARGET AUDIENCE

The potential beneficiaries are companies and public institutions in the field of the following sectors of activity:

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement).

POTENTIAL BENEFICIARIES

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement)

REQUIRED MATERIALS AND RESOURCES

- solar simulators
- IQE-200 system
- multimeters
- function generator
- current and voltage sources
- hot air station
- soldering station.
- spectrum analyzer
- oscilloscopes
- photovoltaic experimental platform
- inverters
- other auxiliary equipments / materials / softwares.

24 MULTI-VECTOR ENERGY ASSESSMENT AND OPTIMIZATION OF ENERGY MIX







OBJECTIVE

This service focuses on evaluating and optimizing energy systems that combine multiple energy carriers ("vectors"), such as electricity, heat, gas, and renewable sources. It is particularly relevant for industrial sites, energy-intensive facilities, and smart energy projects seeking to improve overall system efficiency.

The institute performs comprehensive assessments of current energy usage, identifying opportunities to integrate different energy sources more effectively. This includes analyzing energy flows, storage options, and conversion technologies (e.g., power-to-heat, power-to-gas), as well as evaluating the potential for renewable integration.

Using advanced modeling and simulation tools, the service quantifies the technical and economic benefits of different energy mix scenarios. Clients receive clear recommendations on how to reduce costs, increase efficiency, and improve resilience, while also lowering carbon emissions.

This approach is increasingly important as energy systems become more complex and interconnected, and as companies seek flexible, future-proof solutions in response to market volatility and regulatory pressures.

MANAGEMENT LOGIC

We combine advanced infrastructure with multidisciplinary expertise to transform ideas and research into applicable solutions, with a high Technology Readiness Level (TRL). We work closely with beneficiaries to understand industrial needs, reduce technological risks, and accelerate the integration of innovation into products and processes.

TARGET AUDIENCE

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement).

1 DATA COLLECTION
Energy consumption analysis and system characterization

2 ENERGY FLOW ANALYSIS
Mapping and assessment of multi-vector energy flows

3 MODELING & SIMULATION
Technical and economic modeling of energy mix scenarios

4 EVALUATION
Comparison of scenarios based on cost, efficiency, and emissions

5 RECOMMENDATIONS
Action plan for optimal energy mix and system improvements

6 IMPLEMENTATION SUPPORT
Support for integration, monitoring and continuous optimization.

POTENTIAL BENEFICIARIES

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement)

REQUIRED MATERIALS AND RESOURCES

- experimental platforms (PV&ST)
- building management system
- energy management system
- function generator
- current and voltage sources
- hot air station
- soldering station
- spectrum analyzer
- oscilloscopes
- cogeneration system
- inverters
- other auxiliary equipments/ materials/softwares.

EXECUTIVE VERSION

We provide RDI services for the assessment and optimization of multi-vector energy systems. Through advanced analysis and modeling, we quantify benefits, identify optimal solutions, and support implementation to improve efficiency, resilience, and reduce costs and emissions.

FORMAL VERSION

This service includes research-development-innovation activities applied to evaluate and optimize energy systems, including data collection, modeling and simulation, scenario evaluation, and recommendations for the improvement of efficiency, resilience, and sustainability.

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25 LABORATORY CHARACTERIZATION OF PHOTOVOLTAIC CELLS AND PANELS

This service provides detailed laboratory testing and characterization of photovoltaic (PV) cells and modules to assess their performance, quality, and reliability. It is intended for manufacturers, developers, importers, and investors who need independent verification of PV component performance.

Testing is conducted under controlled conditions using specialized equipment to measure key parameters such as efficiency, power output, degradation behavior, and response to environmental stress factors (temperature, irradiation, etc.). The institute can identify defects, inconsistencies, or performance gaps relative to manufacturer specifications.

The results support quality assurance, product benchmarking, and informed procurement decisions. For developers and investors, this reduces the risk associated with component selection and ensures that installed systems will meet expected performance levels.

This service is particularly valuable in a market where PV component quality can vary significantly and where long-term reliability directly impacts financial returns.





POTENTIAL BENEFICIARIES

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement)

REQUIRED MATERIALS AND RESOURCES

- solar simulators
- IQE-200 system
- multimeters
- function generator
- current and voltage sources
- hot air station.
- soldering station
- spectrum analyzer
- oscilloscopes
- photovoltaic experimental platform
- inverters
- other auxiliary (equipments/ materials/softwares).

26 IN-SITU TESTING AND PERFORMANCE EVALUATION OF PHOTOVOLTAIC POWER PLANTS

This combined service covers on-site testing, monitoring, and performance evaluation of photovoltaic (PV) power plants, ensuring that installed systems operate at optimal levels and meet design expectations.

The institute conducts field measurements and diagnostics directly at the plant location, assessing real operating conditions, system losses, and potential faults. This includes verification of energy output, identification of underperforming components, and analysis of environmental and operational factors affecting performance.

In addition, standardized performance tests are carried out to benchmark the plant against design specifications and industry norms. The outcome is a comprehensive performance report, including actionable recommendations for improving efficiency, reducing downtime, and maximizing energy yield.

This service is especially relevant for asset owners, operators, and investors who need to ensure that their PV installations deliver expected returns. It supports both commissioning phases and ongoing operation, contributing to better asset management and long-term profitability.





POTENTIAL BENEFICIARIES

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement)

REQUIRED MATERIALS AND RESOURCES

- multimeters
- SOLAR I-Ve 1500V Multifunction I-V Curve Tracer
- SOLAR300N Power Quality Analyzer for checking the efficiency of photovoltaic systems plus MPP300 Accessory for measuring and recording the efficiency of a single- and three-phase, single- and multi-string photovoltaic system
- PVCHECKs Multifunction device for checking electric safety and performance of a photovoltaic system
- HT7051 Professional insulation meter with programmable test voltage up to 5kV
- MACROTEST G1 Multifunction earth tester for measuring earth resistance, continuity of protective conductors
- other auxiliary equipments/materials/softwares.

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27 HIGH-PRECISION SOLAR IRRADIANCE MEASUREMENT USING KIPP & ZONEN CM21 PYRANOMETER

The Kipp & Zonen CM21 Pyranometer–based solar radiation measurement service represents a premium solution designed for maximum precision, reliability, and scientific accuracy. Developed to meet the highest standards in solar monitoring, this service is widely applied in renewable energy assessment, climatology, agriculture, and environmental research. At the core of the service is the pyranometer-an advanced instrument engineered to measure global solar radiation, including both direct solar irradiance and diffuse sky radiation on a horizontal surface.



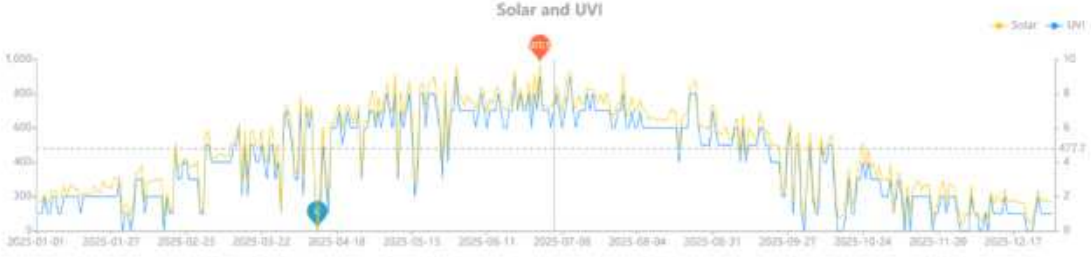
The operating principle of the instrument is based on a vacuum-sealed thermopile sensor. This sensor detects solar radiation across a broad spectral range (200–4200 µm), ensuring comprehensive measurement of infrared energy. The thermopile consists of multiple thermocouples connected in series, forming a highly sensitive system capable of detecting minute temperature differences. When exposed to solar radiation, a temperature gradient is created along with the thermal resistance of the sensor. This gradient is converted into a proportional electrical voltage signal, which directly corresponds to the intensity of the incident of solar radiation. The vacuum sealing of the sensor minimizes heat exchange with the external environment, significantly reducing measurement errors caused by convection and conduction.



By delivering precise and reliable solar irradiance data, this service supports critical applications such as photovoltaic system design and optimization, solar resource assessment, climate studies, and environmental monitoring. Ultimately, it provides decision-makers and researchers with the confidence needed to evaluate solar energy potential and improve energy system performance.







POTENTIAL BENEFICIARIES

- renewable energy assessment
- climatology
- agriculture
- environmental research

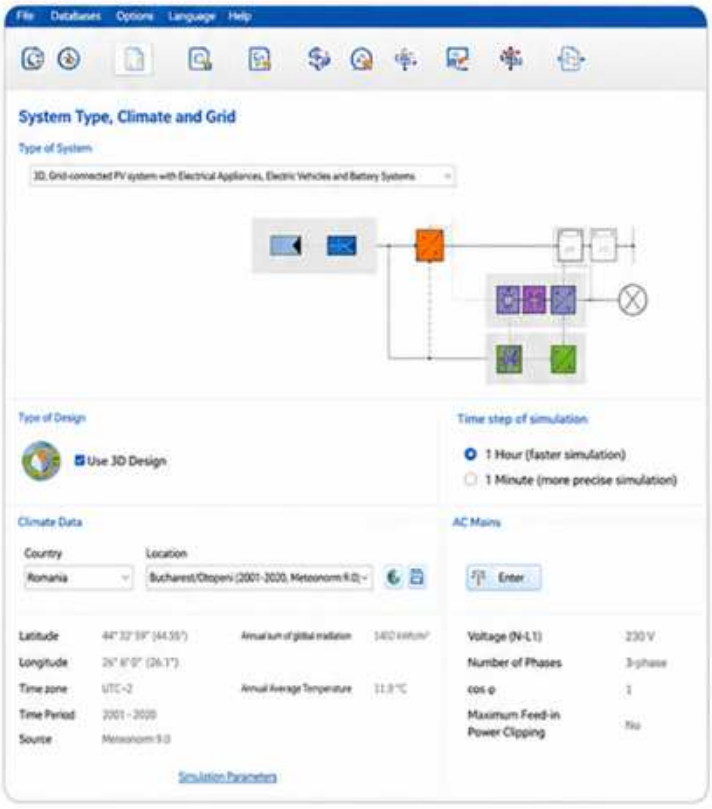
REQUIRED MATERIALS AND RESOURCES

- Kipp & Zonen CM21 Pyranometer
- other auxiliary equipments/materials/softwares.

28 ADVANCED PHOTOVOLTAIC DESIGN & SIMULATION SERVICE USING PV*SOL

The service provides customers with a complete and reliable solution for designing efficient, cost-effective, and sustainable PV systems using PVSOL, developed by Valentin Software. This advanced tool enables fast, accurate configuration, and detailed economic evaluation of PV installations through dynamic simulation and yield calculation. This service includes automatic and manual system configuration, ensuring optimal inverter selection and flexibility for customized solutions. PV modules can be easily positioned using graphical tools, including 2D roof layouts or real building images, allowing precise and visually clear system designs adapted to each project.

A key advantage is the detailed performance analysis, with hourly simulation of energy production and comprehensive economic forecasts, including payback time and system profitability. The software uses continuously updated databases of PV modules and inverters, ensuring reliable and up-to-date system designs. All projects are delivered with professional, configurable documentation suitable for technical and regulatory purposes.



POTENTIAL BENEFICIARIES

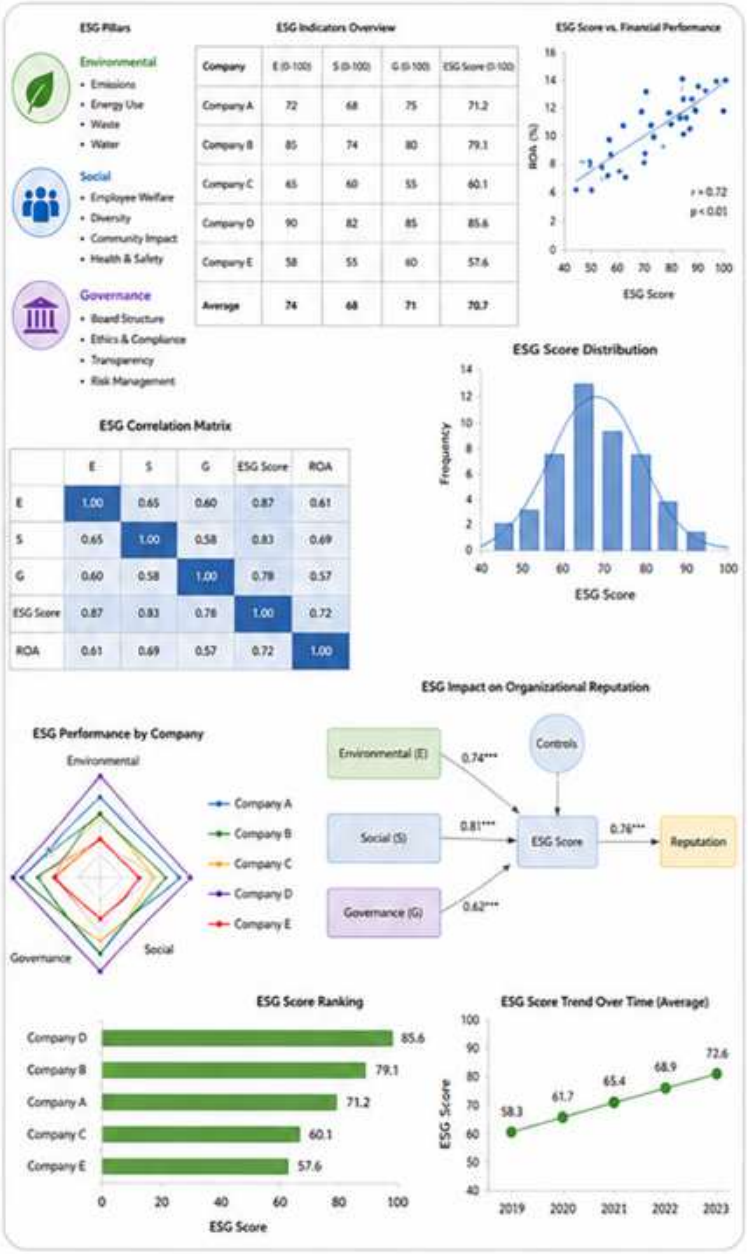
- renewable energy assessment
- agrivoltaics
- environmental research

REQUIRED MATERIALS AND RESOURCES

- PVSOL software (Valentine Software)

29 STUDY ON THE EVALUATION OF ESG PERFORMANCE AND SUSTAINABILITY WITHIN COMPANIES

The service involves the analysis of environmental, social, and governance (ESG) indicators using statistical methods and multicriteria evaluation models. It aims to correlate ESG performance with economic results and organizational reputation.



POTENTIAL BENEFICIARIES

- industry and manufacturing (e.g., food, metallurgy/steel, cosmetics, pharmaceutical, agriculture, etc.)
- energy
- services
- other organizations interested in ESG reporting and alignment with international standards.

REQUIRED MATERIALS AND RESOURCES

- statistical analysis software (SPSS, SmartPLS, Excel)
- economic and ESG databases
- IT infrastructure.

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30 ASSESSMENT STUDY OF IMAGE ENHANCEMENT ALGORITHMS FOR LOW-LIGHT CONDITIONS AIMING AT IMPROVING THE ACCURACY OF AUTOMATED VISUAL INSPECTION SYSTEMS IN INDUSTRIAL APPLICATIONS





The service focuses on the evaluation, development, and optimization of image enhancement techniques applied to images acquired under low-light conditions in industrial environments. The study integrates classical image processing methods (contrast enhancement, denoising, filtering) with advanced deep learning approaches (CNNs, GANs, transformer-based models).

Experimental data are obtained using industrial cameras and controlled lighting systems, followed by processing using software tools. The service includes quantitative evaluation based on performance metrics such as PSNR and SSIM, as well as qualitative assessment of visual improvements relevant for defect detection and quality control processes.

POTENTIAL BENEFICIARIES

- automotive
- electronics
- companies specialized in non-destructive testing and visual inspection
- software development companies focused on computer vision solutions.

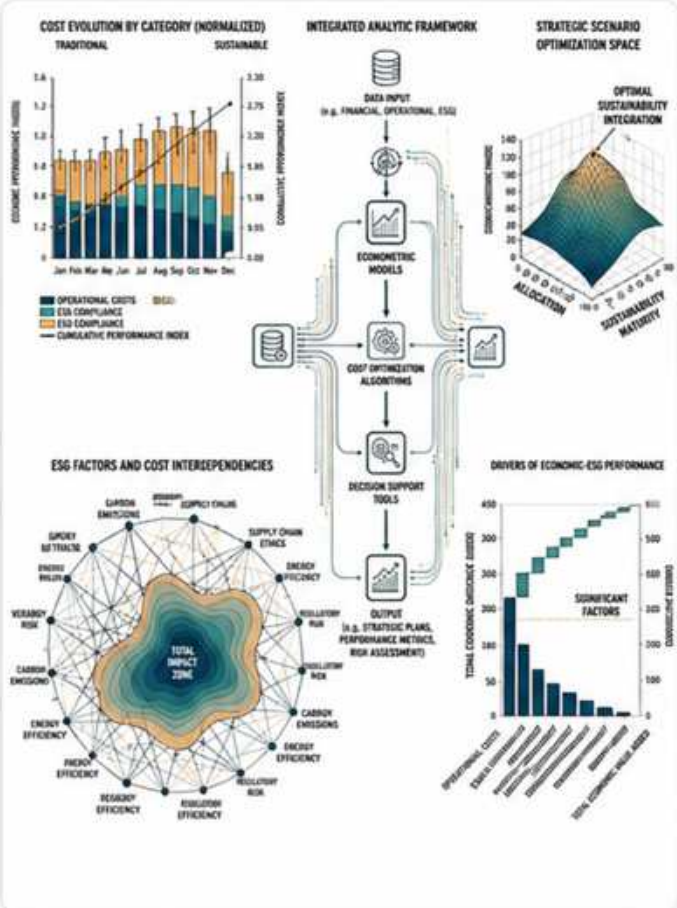
REQUIRED MATERIAL RESOURCES

- high-performance workstations equipped with GPUs (e.g., NVIDIA RTX/A100) for image processing and deep learning model training
- software tools: Python (OpenCV, TensorFlow, PyTorch), MATLAB
- data storage solutions: SSDs, cloud storage for large image datasets
- external storage devices and backup systems
- software licenses (if required)
- experimental datasets and image acquisition setups.

31 STUDY ON THE INTEGRATION OF SUSTAINABLE DEVELOPMENT PRINCIPLES INTO COST MANAGEMENT AND STRATEGIC PLANNING

The service involves the analysis and modeling of cost management systems in correlation with sustainable development principles and ESG requirements. Econometric methods and cost analysis models are employed to identify solutions for resource optimization and the improvement of economic performance.

Strategic scenarios and decision-support tools are developed to facilitate the integration of sustainability into organizational processes.



POTENTIAL BENEFICIARIES

- industry and manufacturing (e.g., food, metallurgy/steel, cosmetics, pharmaceutical, agriculture, etc.)
- energy
- services
- other organizations interested in cost optimization, performance improvement, and the integration of sustainability principles into their operations.

REQUIRED MATERIAL RESOURCES

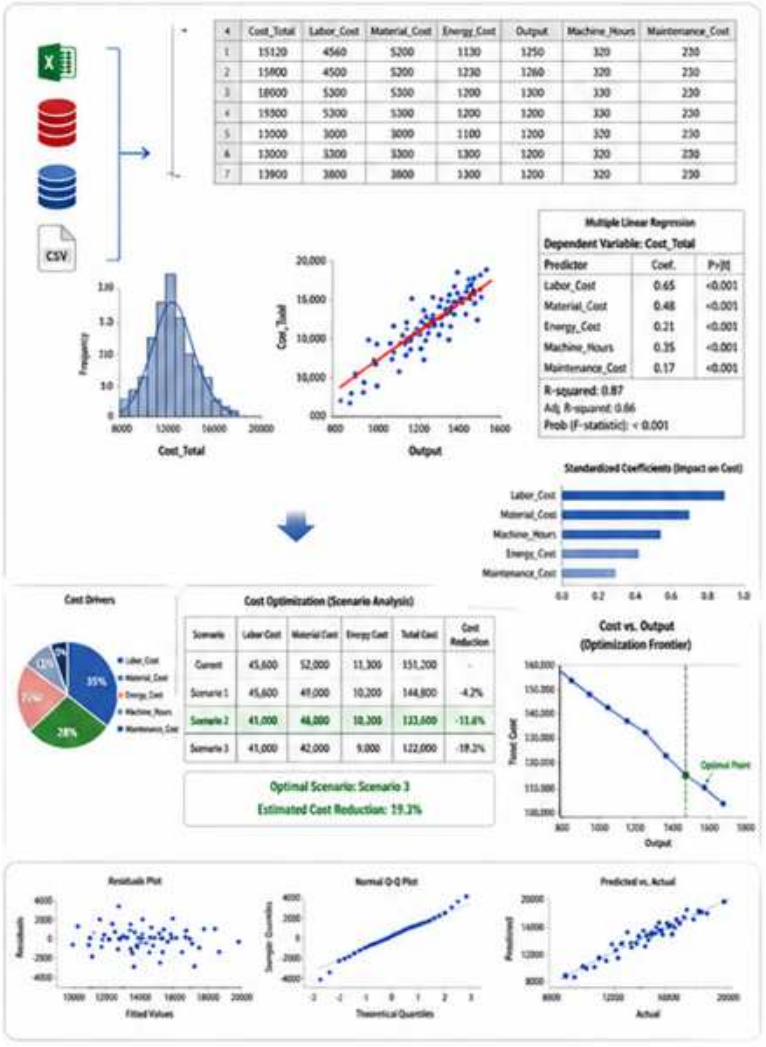
- statistical analysis software (SPSS, SmartPLS, Excel)
- economic and ESG databases
- IT infrastructure

32 STUDY ON OPERATIONAL COST EVALUATION AND OPTIMISATION FOR ENHANCING ECONOMIC EFFICIENCY

The service focuses on analysing cost structures and identifying key drivers of economic efficiency using statistical and econometric methods.

It applies cost function modelling, comparative analysis, and predictive models to identify opportunities for cost reduction and resource optimisation.

The analysis is based on financial records, economic databases, and internal organisational data.



POTENTIAL BENEFICIARIES

- industry and manufacturing (e.g., food, metallurgy/steel, cosmetics, pharmaceutical, agriculture, etc.)
- energy
- services
- other organizations interested in improving operational efficiency, reducing costs, and enhancing financial performance.

REQUIRED MATERIAL RESOURCES

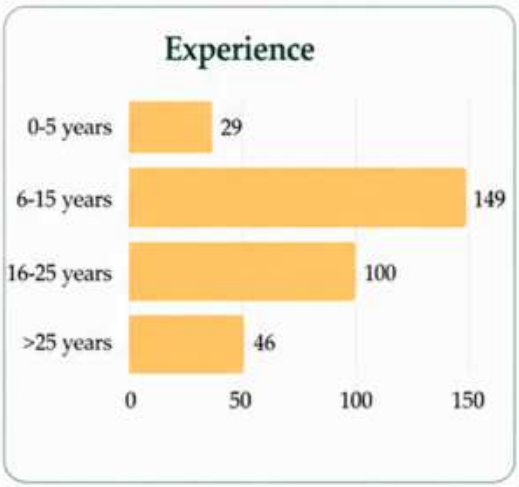
- statistical analysis software (SPSS, SmartPLS, Excel)
- economic and financial databases
- IT infrastructure

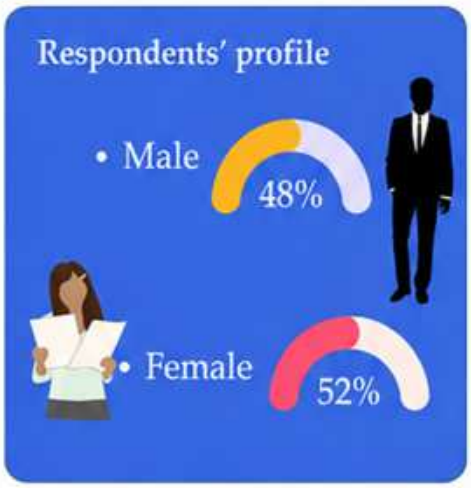
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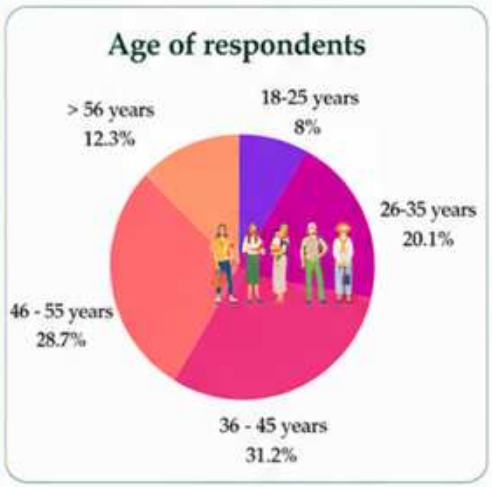
33 STUDY ON STATISTICAL MODELLING OF CONSUMER BEHAVIOUR FOR MARKET STRATEGY OPTIMISATION











The service involves analysing consumer behaviour using advanced statistical methods and econometric modelling. Data collection and processing techniques (surveys, online databases) are employed, followed by regression analysis, segmentation, and forecasting. The results support adapting business strategies and personalising offerings by market segment.

POTENTIAL BENEFICIARIES

- industry and manufacturing (e.g., food, metallurgy/steel, cosmetics, pharmaceutical, agriculture, etc.)
- energy
- services
- other organizations in understanding customer behaviour, market segmentation, and optimising data-driven marketing decisions.

REQUIRED MATERIAL RESOURCES

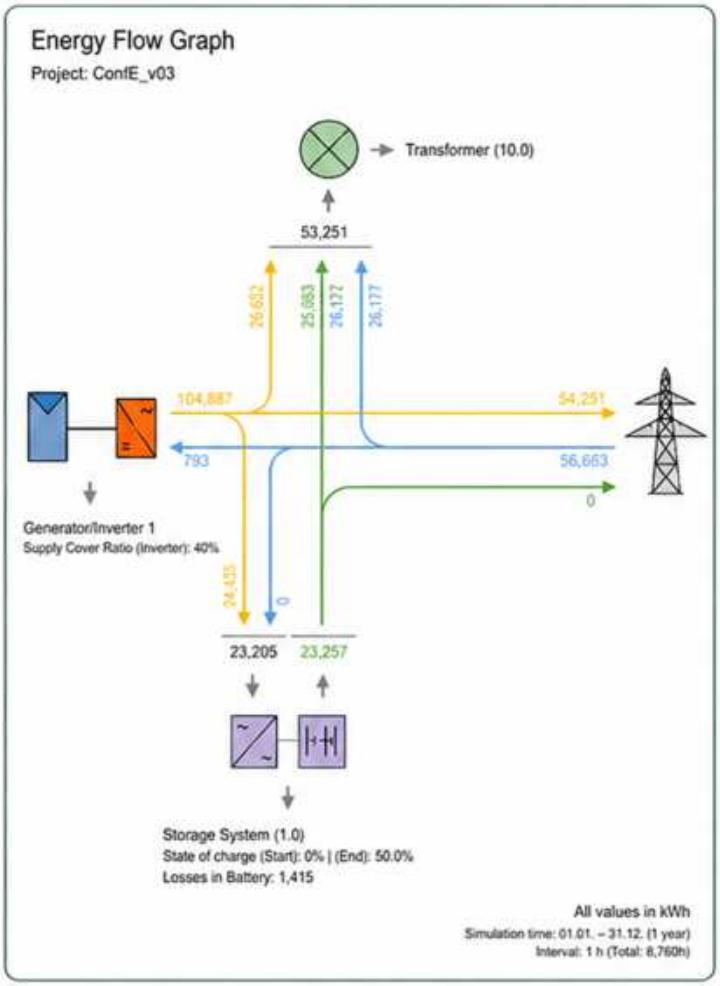
- statistical analysis software (SPSS, Smart PLS, Excel)
- IT infrastructure

34 TECHNICAL CONSULTING AND ENGINEERING SUPPORT FOR RENEWABLE ENERGY SYSTEM DESIGN

This service provides end-to-end technical consulting and expert support for the design and implementation of renewable energy systems, including photovoltaic (PV), wind, and hybrid installations. It is aimed at industrial clients, project developers, and engineering firms seeking reliable, optimized system configurations tailored to specific site and operational conditions.

The institute supports clients across all project phases-from early-stage concept design and feasibility analysis to detailed engineering and system optimization. This includes resource assessment (solar irradiation, wind profiles), system sizing, technology selection, and performance modeling. Special attention is given to integrating renewable systems into existing industrial or commercial energy infrastructures, ensuring compatibility, stability, and cost-efficiency.

A key differentiator is the use of advanced simulation tools and engineering models to predict system behavior under real-world conditions. Clients benefit from reduced technical risk, improved return on investment, and confidence in long-term performance. The service is particularly valuable for organizations navigating complex regulatory requirements or seeking to maximize energy independence and sustainability outcomes.



POTENTIAL BENEFICIARIES

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement)

REQUIRED MATERIALS AND RESOURCES

- Software PV*Sol 2025 R3
- meteonorm 8
- PVgis
- solcast
- NREL meteosat



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35 TECHNICAL CONSULTING FOR ENERGY EFFICIENCY IN BUILDINGS

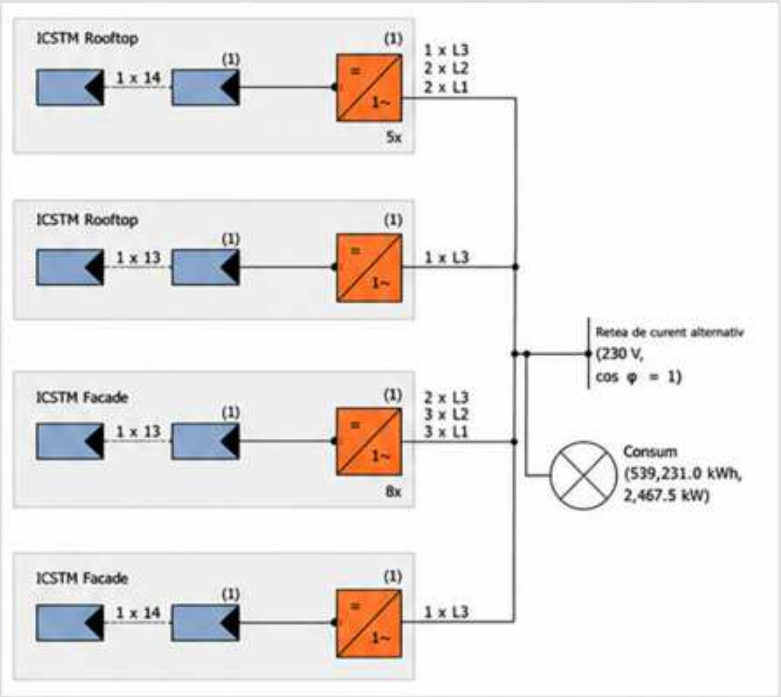
This service focuses on improving the energy performance of residential, commercial, and industrial buildings through advanced technical analysis and targeted optimization measures. It is designed for property owners, developers, and facility managers aiming to reduce energy costs, meet regulatory standards, and enhance sustainability.

The institute conducts in-depth energy audits, identifying inefficiencies in building envelopes, HVAC systems, lighting, and energy management practices. Using data-driven methodologies and simulation tools, it evaluates energy consumption patterns and proposes tailored solutions such as insulation improvements, system upgrades, smart control integration, and renewable energy coupling.

Beyond standard audits, the service can include dynamic energy modeling, lifecycle cost analysis, and support for compliance with European energy performance directives. The outcome is a clear, actionable roadmap for reducing energy consumption and operational costs, often with quantified savings and payback periods.

This service is particularly attractive in the context of rising energy prices and increasing ESG (Environmental, Social, Governance) requirements, where building efficiency is both a financial and strategic priority.

Grid-connected photovoltaic system with electrical consumers	
Climatic data	Targoviste, ROU (2001 - 2020)
Source of values	Meteonorm 8.2(i)
Photovoltaic generator capacity	80.4 kWp
Photovoltaic generator area	392.7 m²
Number of photovoltaic modules	201
Number of inverters	15



POTENTIAL BENEFICIARIES

- IT / digital
- energy / green tech
- non-innovators (need basic services)
- incremental innovators (need process optimization)
- large corporates (often foreign-owned)
- mid-sized Romanian companies
- SMEs (RDI engagement)

REQUIRED MATERIALS AND RESOURCES

- energy management system
- function generator
- current and voltage sources
- spectrum analyzer
- oscilloscopes
- other auxiliary equipments/ materials/softwares

ICSTM

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