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WROCLAW, POLAND

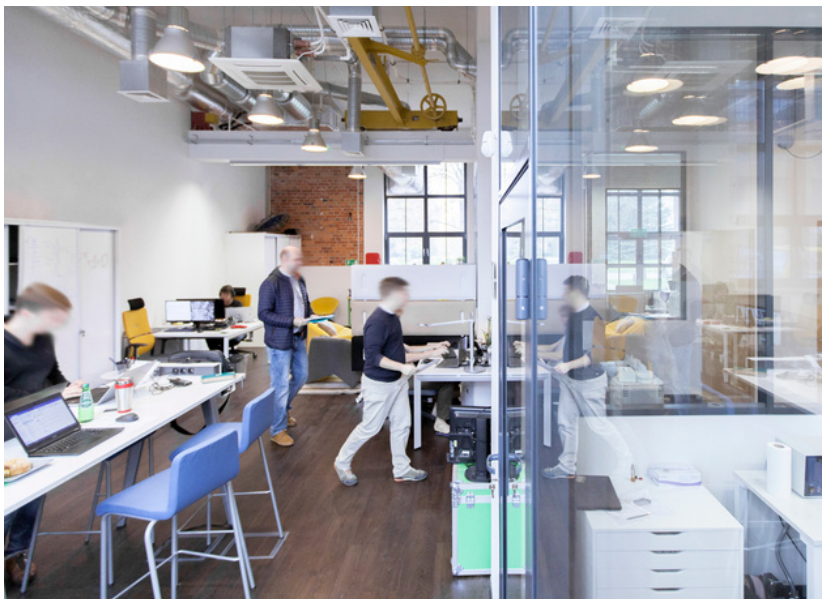
CATALOGUE OF THE R&D LABORATORY

LABORATORY SERVICES
FOR RESEARCHERS AND INDUSTRY

The state-of-the-art independent
LABORATORY
OF NANOTECHNOLOGY
in Poland

nanores lab

ABOUT OUR WORK



The Nanores Lab's staff is a team of engineers and scientists from various scientific fields who can be entrusted with research services, creating breakthrough solutions or seeking answers to pressing questions.

dr inż Aneta Zięba,
Head of Laboratory
Technical Development

MISSION

We are a modern, independent research and development laboratory focused on providing the highest quality services and raising the standards of cooperation between science and business.

20 implementation PhDs

state-of-the-art equipment of nanotechnology laboratory

individual approach

quickness of realization tests even from 24 hours

highest quality of analyses

APPLICATIONS -
WHAT DO WE RESEARCH AND MANUFACTURE?

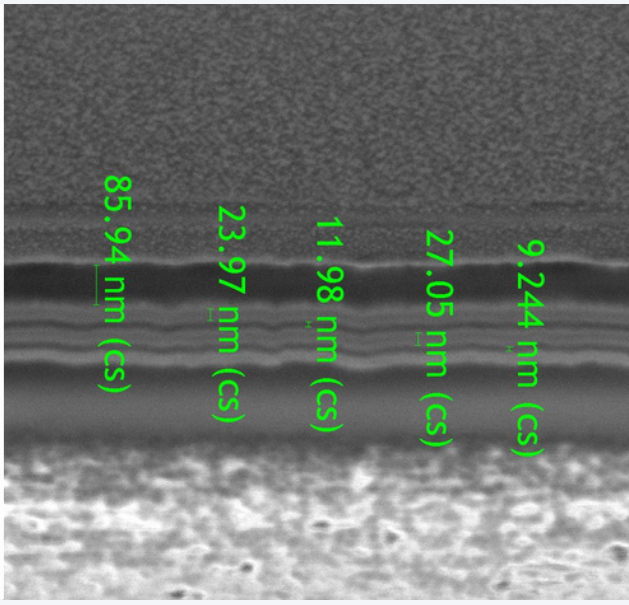
TESTING OF THE PROPERTIES AND STRUCTURE OF MATERIALS

We verify the key properties of materials and their structure using basic laboratory techniques such as metallographic tests and hardness measurements, as well as advanced imaging methods like scanning and transmission electron microscopy (SEM, TEM) or atomic force microscopy (AFM).

Scanning electron microscopy (SEM) is an excellent technology that allows imaging the sample surface at a micro- and nanometric scale, achieving the magnification of up to 1,000,000 times and visualizing its topography or structure. Observations made with a number of specialist detectors provide a comprehensive set of information, e.g. distribution of elements obtained by EDS/EDX microanalysis of chemical composition. Moreover, the microscopes used in the research are built in a dual beam microscope configuration, which allows for making precise local cross-sections through the tested elements, up to several hundreds µm depending on the material, making their inner microstructure visible.

THIN FILMS TESTING

Many industries see the application of specialized coatings in a wide range of complexities and forms. A common critical feature of coatings is their thickness and chemical composition, which often need to meet strict requirements of manufacturers. These parameters translate directly into the quality and reliability of manufactured components. For specialized coatings made of precious and semiprecious metals, their thickness must be strictly controlled within certain ranges. The measurements of coating thickness offered by Nanores Lab allow for precise determination of coating thickness at a location specified by the client. High-resolution imaging mode allows for multi-layer coating measurement starting from 10 nm thickness.

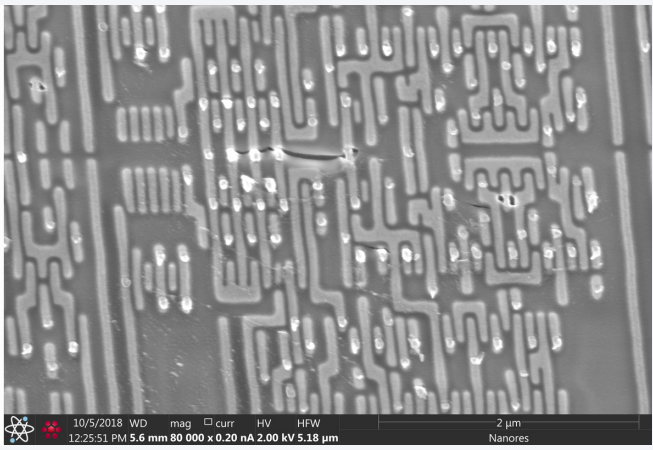


LITHIUM-ION BATTERIES TESTING

Comparing to other battery technologies available on the market, lithium-ion batteries are highly efficient energy storage devices, and demand for them continues to grow. Safer, stronger, more economical batteries are now one of development challenges of the future. Nanores Lab offers a number of tools for identification and analysis of defects, faults and failures. By combining analytical techniques such as microcomputed tomography (microCT), scanning and transmission electron microscopy (SEM and TEM), as well as focused ion beam technology (FIB) scientists, engineers and technologists can gain valuable structural and chemical information that they need to improve their processes.

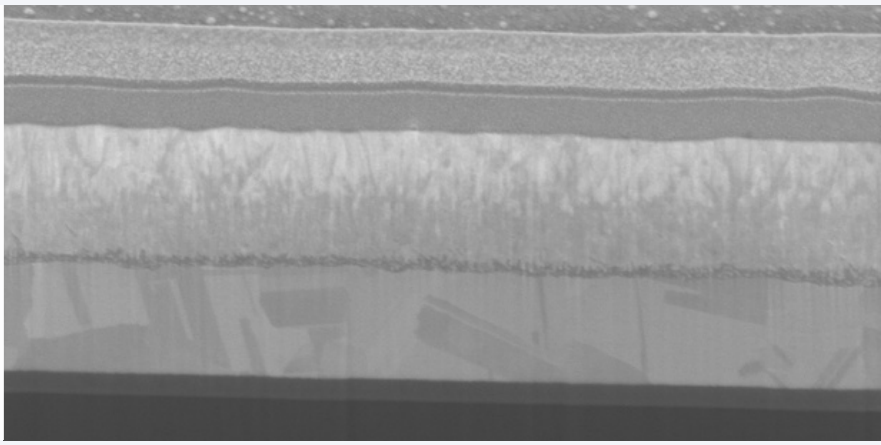
SEMICONDUCTORS TESTING

Semiconductor industry continues to develop and the state-of-the-art semiconductor devices are not only getting smaller than their precursors, but also more complex. As a result, they require more sophisticated tools needed for development, prototyping, identification and control of defects, as well as making precise and high-resolution microscopic observations. Scanning electron microscopy (SEM) in combination with focused ion beam (FIB) is a perfect technique that offers high-precision analytical capabilities.



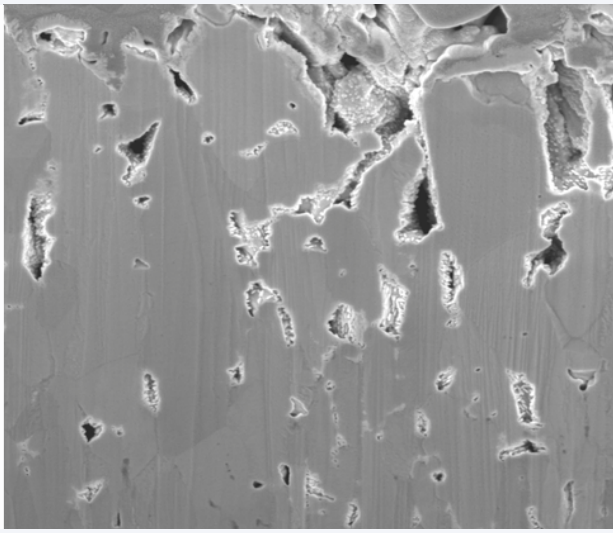
QUALITY CONTROL

Products are becoming more complex, as are the demands placed on them, so a fast, in-depth and multifactor quality control is essential for process management. Thanks to a comprehensively equipped laboratory and a team of experts, complex problems related to damage analysis and determining its root causes can be easily identified and solved.



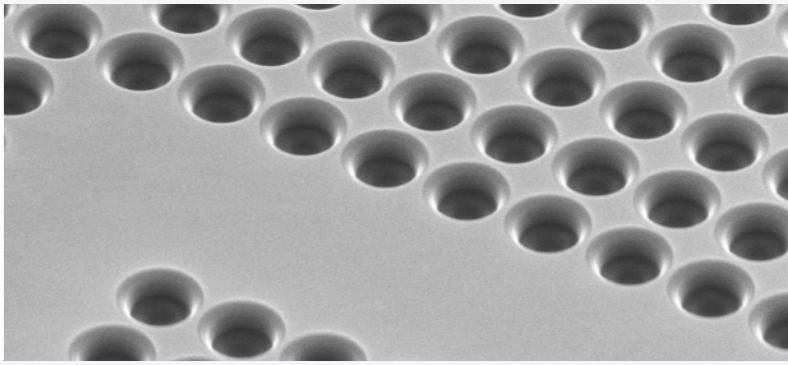
DEFECT ANALYSIS

Even small defects can have a significant impact on the safety and performance of the final product. The slightest crack or contamination can not only reduce the quality and durability of the product, but also cause disastrous failures. Performing metallographic tests and hardness measurements is often the first step to identify the cause of a defect. Some applications and defect cases require the use of electron microscopy techniques. SEM offers magnification and depth of field required for detailed fault analysis and failure identification. It also provides a lot of information to precisely characterize the damage and identify its root cause.



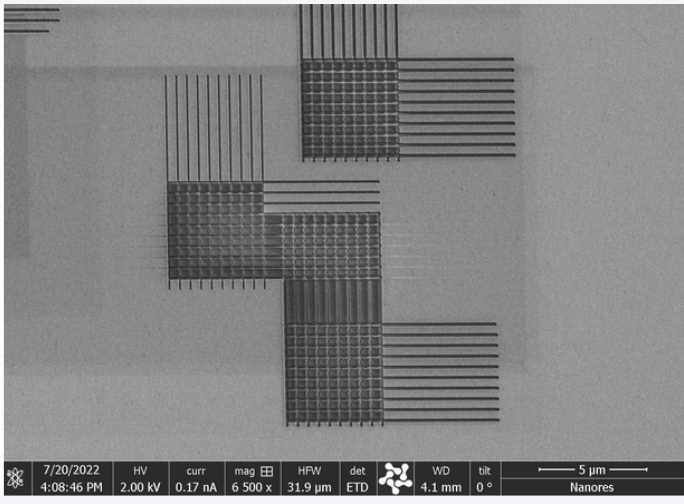
PROTOTYPING

Using our specialist equipment, as well as knowledge and experience, we are able to offer the services of structure prototyping in the following areas: micro- and nanoelectronics (NEMS, MEMS), automatics (micro- and nanofluidics), optics (photonic crystals, micro- and nanolenses) and many others.



MICRO- AND NANOCOMPONENTS PRODUCTION

The manufacture of components at the micro- and nano-scale is a subject of the increasing interest around the world, both in academia and industry. Such components require high precision, repeatability and thorough quality control already at the production stage. Using the high-class equipment, methods and experience of our experts, we are able to manufacture precise components for such industries as: electronics and photonics, optics, automatics, and many others.

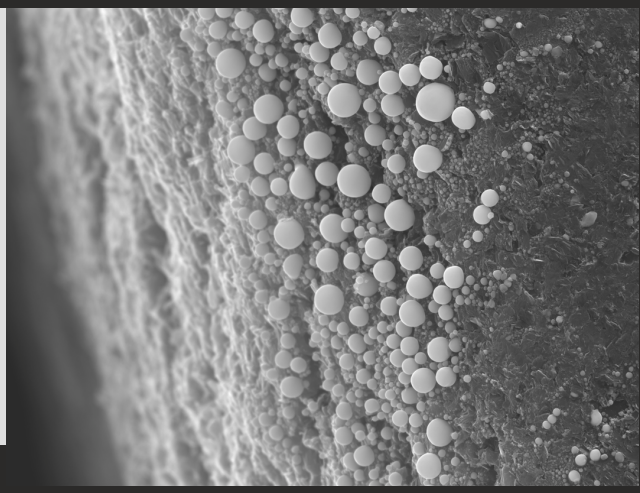


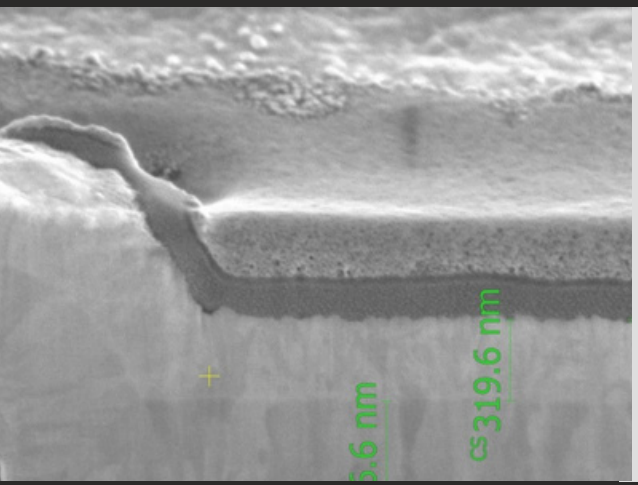
TESTING METHODS

For more information about laboratory's offer can be found at the website (link).

SURFACE TESTING (SEM)

Scanning electron microscope (SEM) images provide information about the morphology or topography of a sample, fracture or polished section. They also allow for the observation and identification of defects even of sub-micron sizes, the measurement of size of grains, pores or other details on the surface. The results of such analyzes provide valuable information to companies and research entities from many industries, such as electronics, chemical, ceramics, metallurgy and many others.



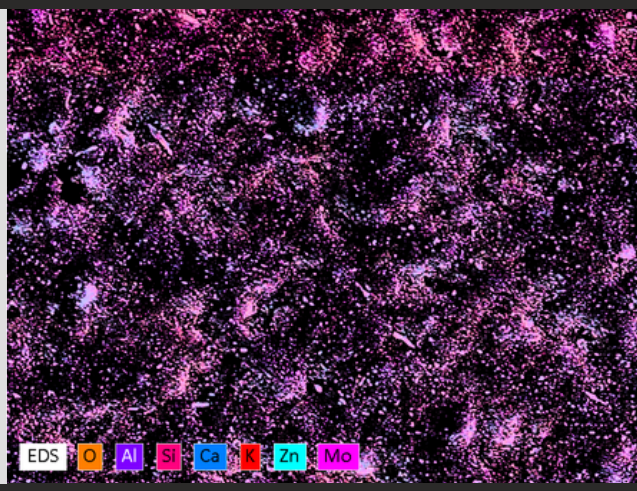


CROSS-SECTION TESTS (SEM/XE-PFIB/GA-FIB)

During these tests, a local cross-section is created, the surface of which is polished with an ion beam. This allows for the cross-sectional area analysis of the tested object using electron and ion microscopy techniques. These tests are perfect for analyzing the quality of sinters, welds and multi-layer structures (e.g. integrated circuits or anti-reflective coatings).

EDS ELEMENTAL ANALYSIS

During electron beam imaging, the preparation atoms emit characteristic X-rays that are unique to each element. An advanced EDS detector collects this signal and performs elemental analysis pointwise, linearly or on the surface. It is possible to create a map that shows the identified elements arrangement from 4Be to 95Am in a given area of the analyzed sample.



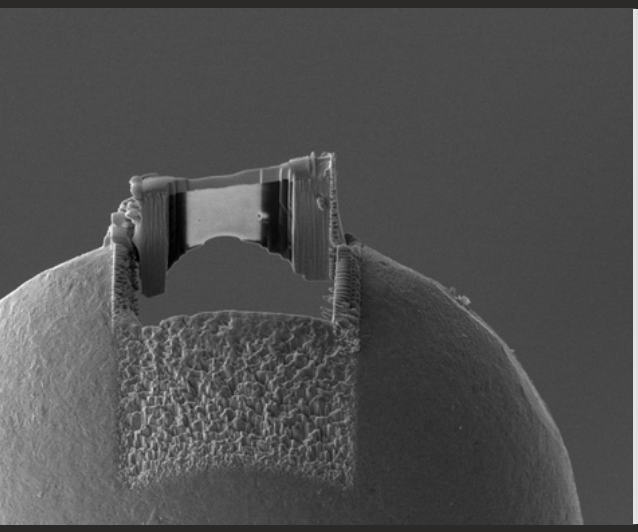
METALLOGRAPHIC EXAMINATION

Metallographic studies enable the analysis of the internal structure of metallic materials, composites, electronics, plastics, and ceramics using optical and scanning electron microscopy. This methodology enables a deeper understanding and characterization of the inner structure of materials, a crucial aspect across various scientific and industrial domains. The primary objective of metallographic investigations is to identify, describe, and gain insight into the microstructure of the material.

During the research, the structure of the material, its components, their arrangement, as well as the assessment of the quality and homogeneity of the material are determined. Metallographic examinations enable the detection of potential defects, inclusions, non-uniformities, or microcracks that could affect the strength or functional properties of the material.

HARDNESS MEASUREMENTS

Hardness measurements are crucial and fundamental material tests that allow for the determination of their resistance to plastic deformation and scratching. The laboratory is equipped with a hardness tester that enables the use of popular measurement methods such as Vickers, Brinell, and Rockwell over a wide range of loads from 0.01 kgf to 250 kgf. This versatility enables us to customize measurement techniques to suit specific applications and material hardness levels, thus aiding in the precise evaluation of material mechanical properties and quality.

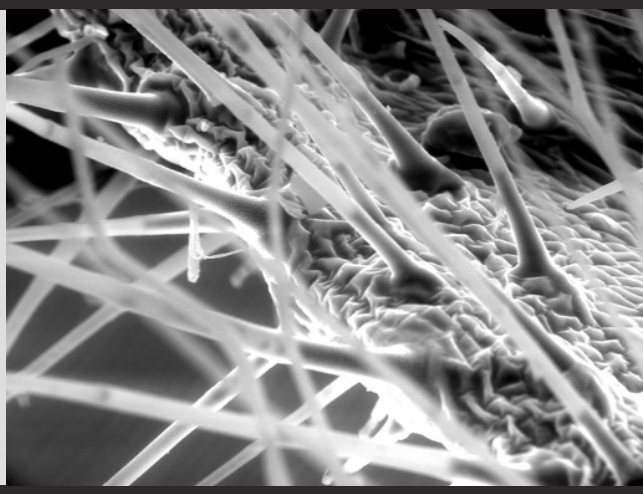


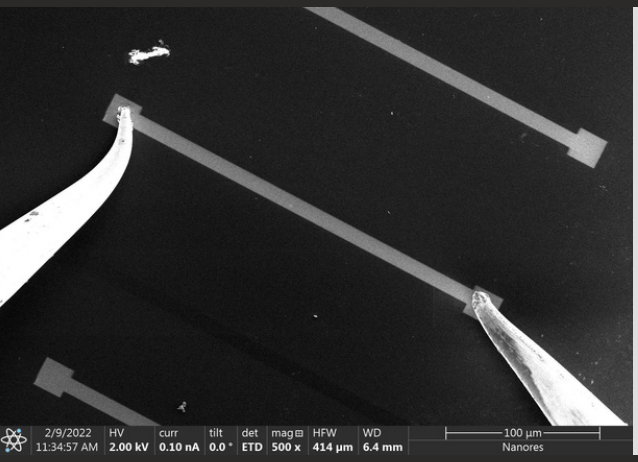
TEM SAMPLE PREPARATION

Our offer includes manufacturing extremely thin samples (lamellas) intended for tests using Transmission Electron Microscopy (TEM). The sample thickness that is guaranteed by us is below 100 nm (depending on the material, the sample thickness may even be less than 20 nm). The lamellas are prepared by us from the sample area indicated by the client, polished and ready for TEM observation. The Xe-PFIB technology, due to xenon ions usage, enables the preparation of samples that are incompatible with Ga-FIB technology, including aluminum samples or samples containing gallium.

ENVIRONMENTAL SEM ANALYSIS

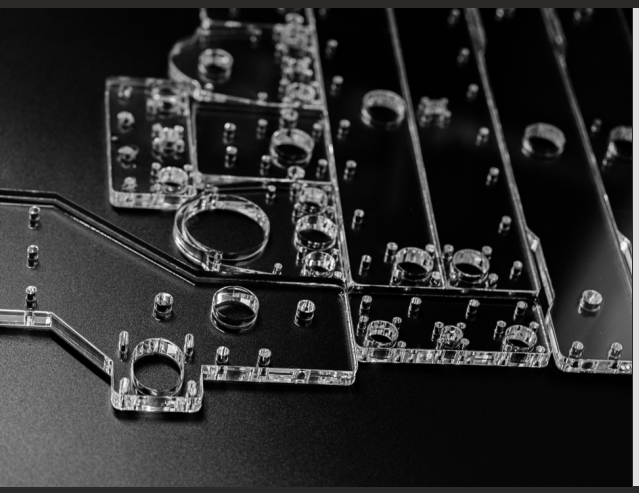
Owing to controlled vacuum, environmental SEM imaging allows for testing biological and other preparations that begin to gas under high vacuum conditions. In this mode, we can control humidity and temperature. As a result, various materials can be introduced into the microscope chamber without the need to dry them. These can be samples in liquid and solid form, highly humid samples, and all samples incompatible with high vacuum, e.g. plant and animal tissues.





MIBOT MANIPULATORS

Manipulators driven by piezoelectric actuators allow for small electronic circuits and components to be tested and moved with nanometric precision. A set of two MiBot devices, coupled with a scanning electron microscope or a laser confocal microscope, allows for research and testing of submicron elements. Moreover, in combination with external measuring electronics, it enables the determination of resistance and current-voltage characteristics of microelectronic devices, or semiconductor damage analysis.

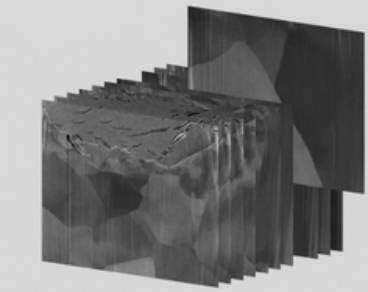


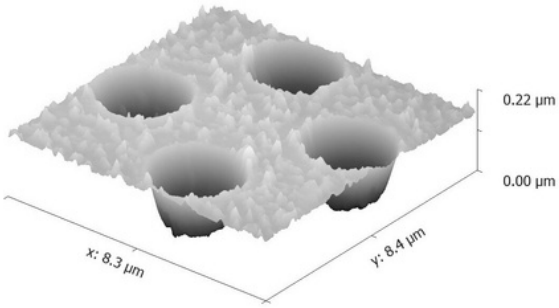
LASER PROCESSING (FEMTOSECOND LASER)

Our workstation can cut difficult materials, e.g. ceramics, diamonds or hardened glass. It is suitable for micro-processing and micro-components production. It is also widely applied in the processing of optical elements (photonic crystals, fiber-optic cables, micro-lenses) and micro-electro-mechanical systems (MEMS). It is used, for example, for drilling micro-holes with profiled, smooth edges, cutting out elements or materials marking.

3D RECONSTRUCTION (SEM/XE-PFIB/GA-FIB)

With our advanced devices and professional software, we are able to perform cross-sections series and then record them in a micro- and nanometric scale. The results of this process can then be transformed into high-quality 3D reconstructions of the sample microstructure. This enables the structural changes verification and their statistical analysis within a certain sample volume.





SURFACE TESTING (AFM)

Surface testing using an atomic force microscope is an ideal method of examining the materials roughness and verifying the correctness of the processes of applying all layers at any production stage.

For more offer information, visit www (link).

EQUIPMENT

SEM/GA-FIB FEI HELIOS NANOLAB 600I MICROSCOPE

The FEI dual beam SEM/Ga-FIB microscope combines the advantages of an ultra high-resolution electron microscope and an ion microscope. It can therefore be used for high-resolution imaging and as a material processing tool. The energy of the focused beam of gallium ions allows for the preparation material to be selectively removed and modified at the nanoscale. This is related to the possibility of making cross-sections, 3D reconstruction and TEM samples preparation, as well as prototyping processes in nano- and microscale. Available detectors: ETD, TLD, CBS and EDS.

SEM/XE-PFIB FEI HELIOS G4 PFIB CXE MICROSCOPE

Helios G4 PFIB CXe is a dual beam microscope with an electron column and an ion column that generates a xenon ions beam. Xenon plasma focused ion beam (Xe-PFIB) technology allows for new tests, unattainable by other methods. In combination with an ultra-high-resolution electron microscope and a fast EDS detector from Bruker, it is the only such analytical system commercially available in Poland. It is distinguished, among others, by up to 50 times faster work than in the case of gallium technology (Ga-FIB), no ion implantation and compatibility with most materials – including aluminum samples and gallium-containing samples. Available detectors: ETD, TLD, ICE, ICD and EDS.

QUANTA 3D 200I ESEM/GA-FIB MICROSCOPE

Quanta 3D 200i ESEM/Ga-FIB microscope combines an electron microscope, based on a tungsten cathode, and an ion microscope. Its great advantage is the possibility of using three imaging modes: high vacuum (Hi-Vac), low vacuum (Lo-Vac) and environmental (ESEM). Depending on the sample type, the microscope's resolving power is estimated at approx. 300–500 nm. In the low vacuum mode (Lo-Vac), images of dry non-conductive samples can be obtained without any pre-preparation. On the other hand, environmental SEM – due to the controlled vacuum – allows for the testing of biological and other preparations that begin to gas under high vacuum conditions. These can be samples in liquid and solid form, highly humid samples and all samples incompatible with high vacuum. Available detectors: ETD, BSE, LFD for Low Vac and GSED for ESEM mode.

More information about the equipment on the website (link).

OLYMPUS LEXT 3D MEASURING LASER MICROSCOPE OLS5000-SAF CONFOCAL MICROSCOPE

The Olympus LEXT 3D confocal microscope allows for precise measurement of shape and surface roughness of samples at the submicron level. Performing accurate 3D measurements on a wide range of sample types, it provides reliable data needed to ensure the quality and control of manufacturing processes. At the same time, this microscope offers the imaging of the microstructure of materials, which allows for basic verification of the material compliance with requirements – including the analysis of potential defects such as non-metallic inclusions, microcracks, porosity or other material discontinuities.

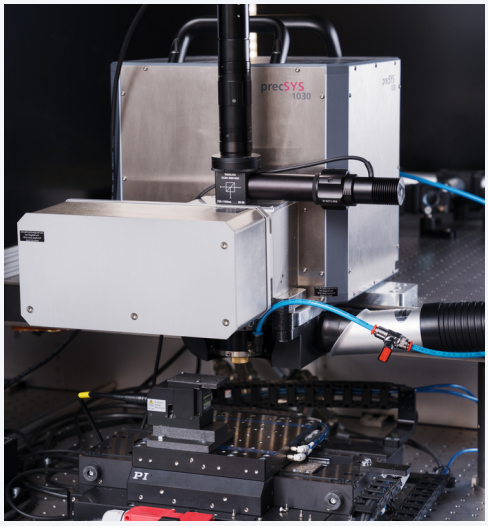
METALLOGRAPHIC LABORATORY SETUP

Our advanced laboratory setup facilitates the preparation of material samples for in-depth analysis. We have the capability to perform imaging using various techniques, including laser confocal microscopy, optical microscopy, scanning and transmission electron microscopy, as well as atomic force microscopy. These techniques enable the assessment of surface quality and the evaluation of microstructure morphology across a wide range of scales, from the nano to the macro level.

NEMESIS 51000G2/A HARDNESS TESTER

The fully automated NEMESIS 51000G2/A hardness tester allows for measurements using Brinell, Vickers, and Rockwell methods within the load range of 0.010 kgf to 250 kgf. It is a significant tool for evaluating the strength and mechanical properties of materials.

LASER WORKSTATION



The unique laser workstation constructed by our team from independent elements consists of a femtosecond laser, a five-axis head (operating, among others, in the trepanation mode) and a movable table increasing the production capacities of even very complex geometries. Its advantages include also the minimization of thermal interactions in the processed material, allowing for very precise and clean work, without the need for further processing. It is suitable for micro-processing and micro-components production. It is also widely applied in the processing of optical elements (photonic crystals, fiber-optic cables, micro-lenses) and micro-electro-mechanical systems (MEMS).

More information about the equipment on [the website (link).]

INDUSTRIES

Our portfolio includes a variety of applications and testing methods that perfectly meet the needs of quality improvement and R&D in industry. A private laboratory also means easy access for researchers to state-of-the-art research equipment. With our services we also support start-ups in the development of innovative technology that requires nano- and micro-manufacturing or materials research.

UNIVERSITIES AND RESEARCH INSTITUTES

START-UPS

INDUSTRY

ELECTRONICS AND PHOTONICS

AEROSPACE & AUTOMOTIVE INDUSTRY

ARMY

SEMICONDUCTORS

BATTERIES AND RENEWABLE ENERGY RESOURCES

3D PRINTING

NANOTECHNOLOGY

JEWELRY INDUSTRY

PARTNERS

and a lot more

CONTACT

Please contact us with a brief description of your research or development needs to receive a service recommendation from an R&D expert.

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