nanores lab

about us

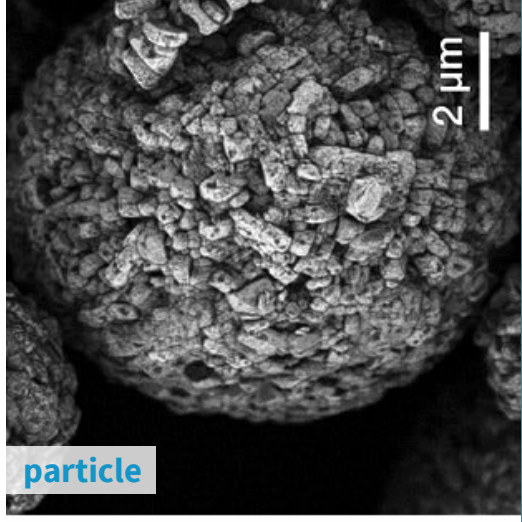
the state-of-the-art independent laboratory of nanotechnology in Poland

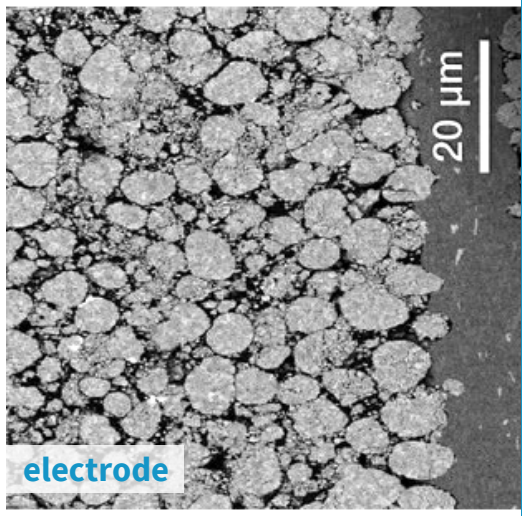
BATTERY TESTING is our specialty through a comprehensive set of resources made up of the most cutting-edge laboratory equipment, qualified researchers and engineers, as well as extensive experience.

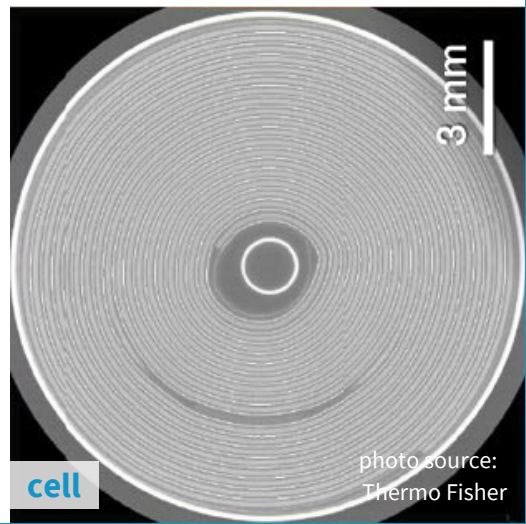
battery technology

Batteries are critical components of our everyday lives, found almost everywhere – from the mobile device we all carry daily, up to the means of transport we use to travel. In the context of global efforts meant to reduce the environmental footprint, including energy-efficient electric vehicles and sustainable energy sources, new and improved battery technology is gaining importance.

Offering superior energy and power density performance over other commercially available battery technologies, lithium-ion batteries are highly efficient energy storage devices with a market that continues to grow at double-digit rates. Safer, more powerful, longer lasting and more cost effective batteries are now the developmental challenge of the future.







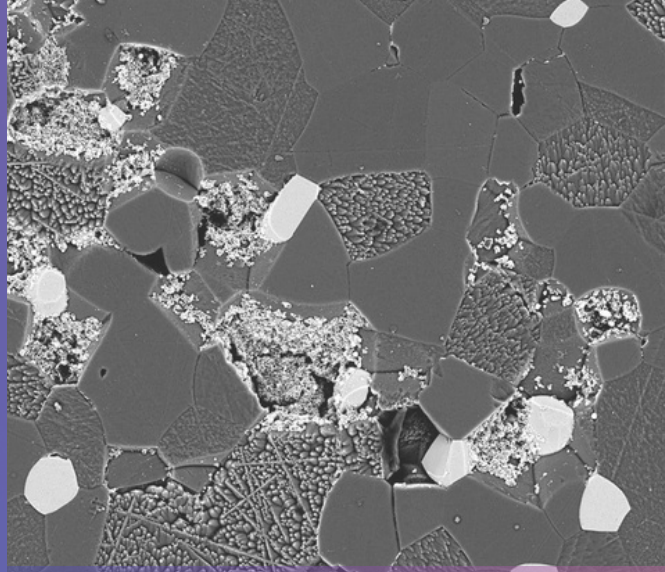
- qualified team of engineers and scientists
- most modern nanotech laboratory equipment
- highest analysis quality
- individual approach
- short testing lead times

quality control

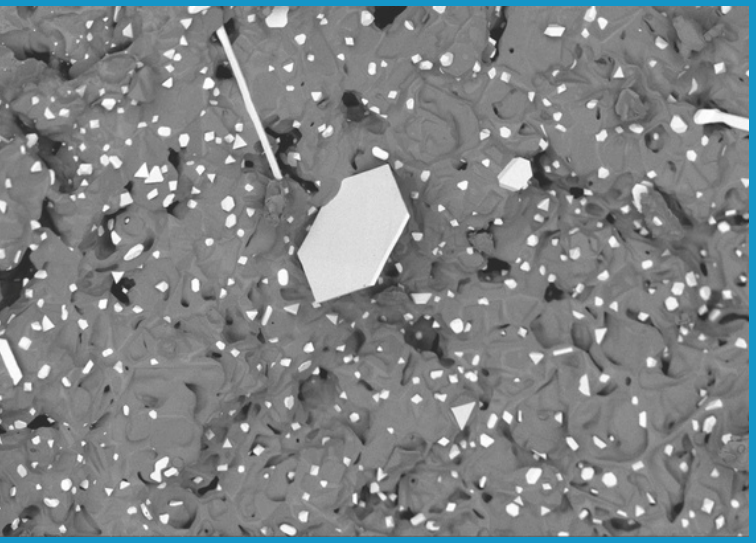
Failure analysis and quality control based on high-resolution electron microscopy and spectroscopy

Modern industry relies more and more heavily on quality control and quality assurance for manufactured parts. These are indispensable elements when faced with growing complexity and ever higher standards of reliability imposed on new products. Failure analysis constitutes a critical aspect of quality oversight, providing insights into the root cause of component/material failure, establishing manufacturing quality control metrics and enforcing 3rd-party quality requirements. As numerous small, microscopic defects often lead to component failure, observing these factors on an extensive scale and assessing them in quantitative terms is the only way to formulate an accurate description that is needed for root cause determination.

Nanores Lab offers a range of tools for monitoring consistency, based on holistic identification and investigation of defects, faults, and failures. X-ray microtomography (microCT) is used for large volume analysis. This non-destructive technique generates 3D reconstructions of samples with micrometer resolution. With the core features identical to well-known hospital CAT scanning technology, microCT provides a practical overview of the material, allowing for identifying the location of defects and isolating them. Once identified, defects may be extracted and undergo more detailed analysis using higher-resolution techniques, such as electron microscopy (EM).



Ceramic coating on steel, imaged at 2 kV. SEM imaging of ceramic coatings can provide insight into failure mechanisms, crack formation/analysis and coating conformity, as well as phases identification.



Apart from unparalleled structural detail, EM offers the added benefit of elemental analysis, facilitated by the X-rays emitted from the sample surface during electron bombardment (energy-dispersive X-ray spectroscopy – EDS, EDX or XEDS). X-ray spectra are characteristic for their source material, while peak intensity corresponds to concentration.

Once armed with such information, engineers and researchers can introduce quality improvements at the earliest stages of defect formation.

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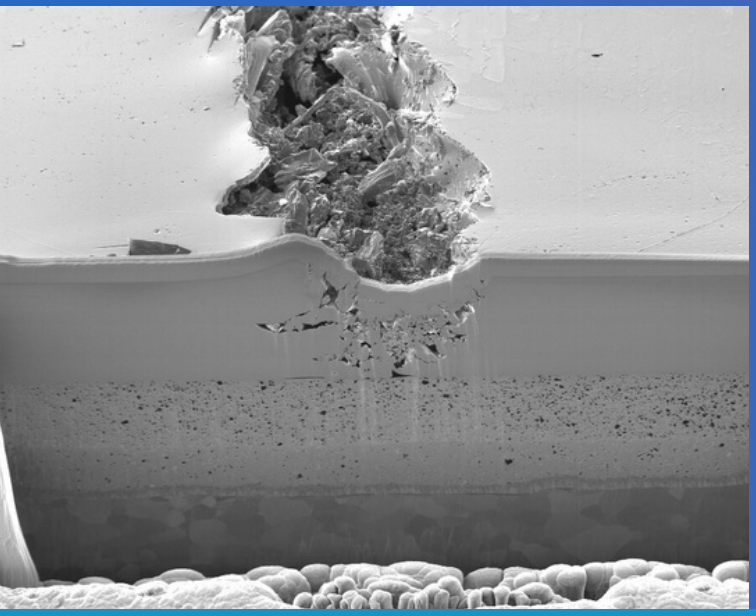
photo source: Thermo Fisher

advanced materials

Novel materials stem directly or indirectly from countless technical innovations. Macro-, micro-, and nanoscale understanding of the physical and chemical properties of materials (morphological, structural, magnetic, thermal, and mechanical) fuels continued research innovation.

Understanding and improving the properties of materials, which is reflected in increasing their utility and value, has a strong body of evidence to support it. Strength, ductility, density, corrosion resistance and electrical conductance, to name just a few, might be the properties decisive for enhancing existing or developing entirely new applications for a particular material.



polymer materials and catalysts

Chemists and chemical engineers pursue a scientific goal of investigating the relationships between material structure and function at the micro- and nanometer level by studying polymers and catalysis. New materials systems are developed through these processes, offering targeted functionality, longer active lifetimes, lower replacement costs, improved strength and better manufacturability.

An entirely new and exciting field of research, nanodevices, is focused on developing miniaturized technology. These new solutions offer unique functionality that may be applied in electronic, magnetic, mechanical and optical systems. Sensors, actuators and microfluidic devices are all in high demand to provide support in tackling global energy, communications and critical monitoring challenges.

materials science research

With growing level of understanding material structures, scientists want to understand how materials behave in response to light, temperature, pressure and other external factors. What also needs to be taken into consideration, two-dimensional observations do not always translate to answers for a three-dimensional world. Imaging, analysis and determining the parameters of materials must be reflected real-world visibility through 3D information covering a variety of environmental conditions.

Safety, clean energy, transportation, human health and industrial productivity would not be possible without innovative materials. Whatever you're up to, be it searching for alternative energy sources or working to create more resistant, lighter materials and sophisticated nanodevices, you can count on Thermo Fisher Scientific. Their product range provides an extensive selection of spectroscopy and electron microscopy tools for fundamental research and designing new materials.

photo source: Thermo Fisher

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lithium-ion battery manufacturing

Ever growing demand for communication and mobility drives the need for more and more energy in our daily lives. This energy needs to be generated and stored in sustainable ways so that we can rest assured that the precious resources of our ecosystem are spared.

With their high energy density and long cycle life, lithium-ion batteries (LIBs) are the tool of choice to power portable electronics, electric vehicles and for use in grid storage. Through the invention and commercialization of numerous innovative materials, battery performance has been increasing in recent times.

As the chemical solutions available have been brought close to perfection, there is still a gap to be bridged in terms of battery process technology, which may yet contribute greatly allowing to achieve the full potential of LIBs. Twin-screw extrusion may be used to optimize battery manufacturing processes, making the product safer, more powerful, longer lasting and more cost-effective. Determining the rheological properties of battery slurries is indispensable for developing an efficient screen-printing process and new formulations.

lithium-ion battery slurry

Along the long and winding path that takes a raw material to become the final battery cell, twin-screw extruders can enhance the critical stage of electrode material (battery slurries) production.

This material is usually manufactured through batchwise mixing of active ingredients, carbon black, solvents, binders and additives in stirred vessels. This process is labor-intensive, bears the risk of batch-to-batch variations and requires production downtimes for cleaning.

Twin-screw compounding offers a continuous production process that yields precisely controlled material shear, heat transfer, material throughput and dwell time. It ensures high reproducibility, requires less cleaning time, at the same time securing high material and labor efficiency.

Unmatched dispersive and distributive mixing capabilities of a twin-screw extruder ensure much more homogeneous cathode pastes as compared to alternative batch mixing in, for example, a dissolver. This process approach may lead to achieving improved material properties.

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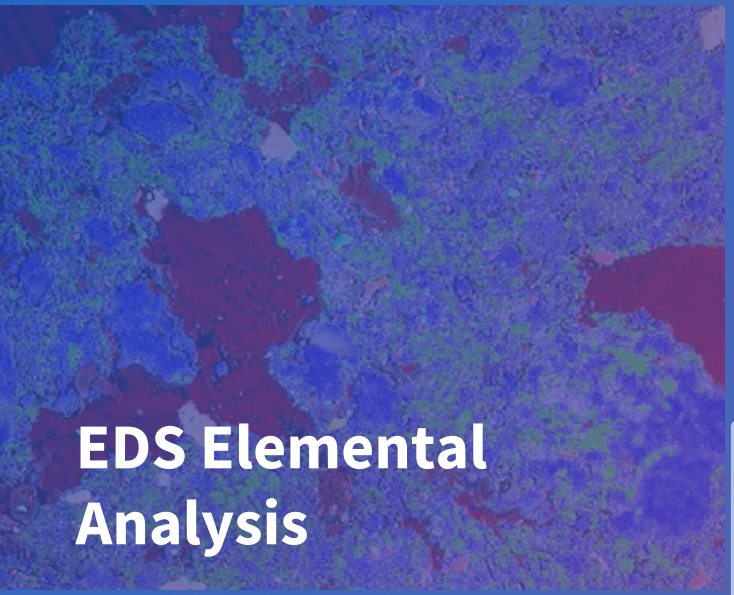
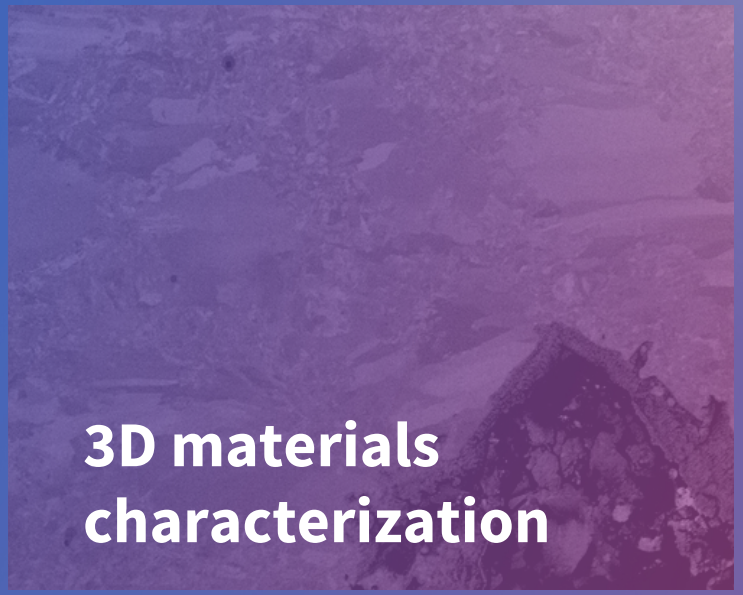
TECHNIQUES



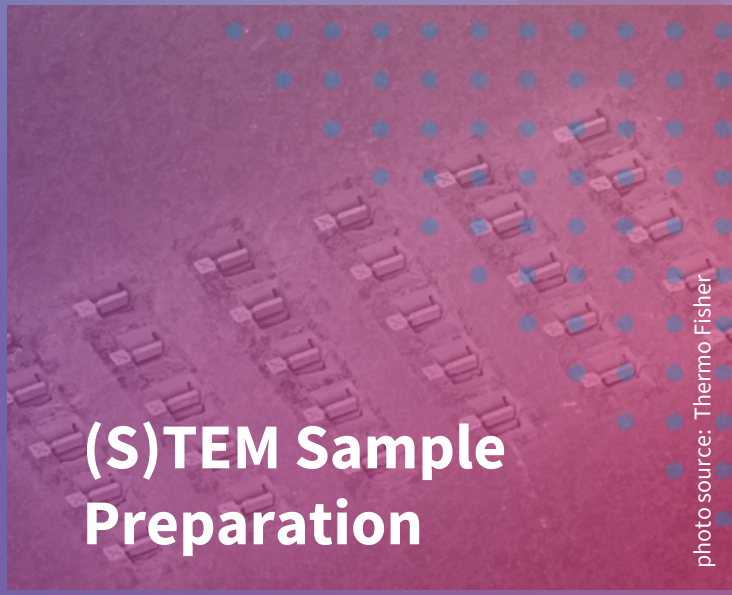
EDS Elemental Analysis

The Phenom Elemental Mapping Software from Thermo Scientific provides fast and reliable information on the distribution of chemical elements within a sample.



3D materials characterization

Material development often requires multi-scale 3D characterization. DualBeam instruments enable serial sectioning of large volumes and subsequent SEM imaging at the nanometer scale. The results of this process may then later be processed into high-quality 3D reconstructions of the sample.



(S)TEM Sample Preparation

DualBeam microscopes enable the preparation of high-quality, ultra-thin samples for (S)TEM analysis. With state-of-the-art automation, there are no particular prior experience requirements for users to achieve expert-level results for a wide range of materials.

photo source: Thermo Fisher

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Contact our specialist to receive this offer tailored to your needs.

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