FT-IR AND RAMAN-MICROSCOPY

Microplastic Analysis

We offer the whole portfolio of instruments

Innovation with Integrity

A Global Problem

Microplastics are polymer particles smaller than 5 mm. They are classified as primary—intentionally manufactured for industrial applications—or secondary, resulting from the breakdown of larger plastic waste. Microplastics are typically analyzed using IR microscopy.

Nanoplastics are defined as plastic particles below 1 µm. Their small size allows them to interact more easily with biological systems, making them a growing focus in environmental and health research. Nanoplastics are typically analyzed using Raman microscopy.

The Importance of Sample Preparation

No matter which spectroscopic technique is used, whether FT-IR or Raman, sample preparation is key. It takes time, skill and patience to remove sand, seaweed, or other unwanted material, to break down organics, and spread the isolated particles on a suitable filter.

We can't automate expertise, but we can make everything that follows as accurate and easy as possible. That's where Bruker's solutions come in. Our instruments offer peace of mind to routine users in microplastic analysis in research and industry.

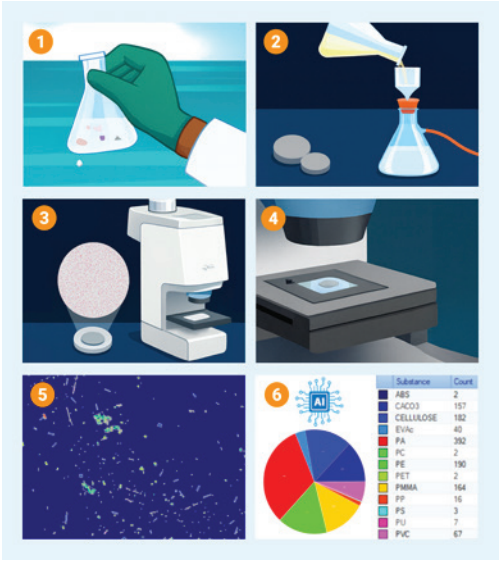


Fig. 1
After sample collection **(1)**, the sample preparation **(2)** is critical to successful microplastics analysis. The remaining steps are straightforward: transfer the sample to the IR or Raman microscope **(3)**, place the filter **(4)**, acquire raw data **(5)**, and derive information on particle size, identity and statistics using autonomous AI-powered tools **(6)**.

The Right Technique

No single tool fits every challenge in particle characterization. That's why Bruker offers a complete portfolio of instruments—so you can choose the solution that best balances depth of insight with speed of analysis.

Infrared (IR) Microscopy

Easily identifies polymers and is the most established tool for reliable microplastics analysis. Particles are measured in transmission, which is a contactless, non-invasive method that can be fully automated for highest throughput.

In IR imaging microscopy, so-called spectral hypercubes are acquired with area detectors. Think of that as a chemical map of your entire particle filter. This enables robust particle characterization based solely on chemical contrast.

IR imaging is a real powerful approach. It's incredibly robust and can be used to spectroscopically analyze whole filters at high spatial resolution, typical of 5 micrometer (pixel size). Mesurement times are predictable and independent of particle count, allowing scalable throughput.

Raman Microscopy

Is especially good at identifying inorganic components and provides spatial resolution at nanometer scale. Particles are measured using the inelastic light scattering of a laser, which is a contactless, non-invasive method.

In Raman microscopy, measurements usually follow an automated point-wise approach. A visual image is used to locate particles, which are then individually analyzed, creating a chemical map step by step."

Raman scattering is an inherently weak effect, which often translates into longer measurement times.
In addition, fluorescence background and the need for carefully optimized acquisition parameters can complicate the process, limiting both automation and robustness.

The Software

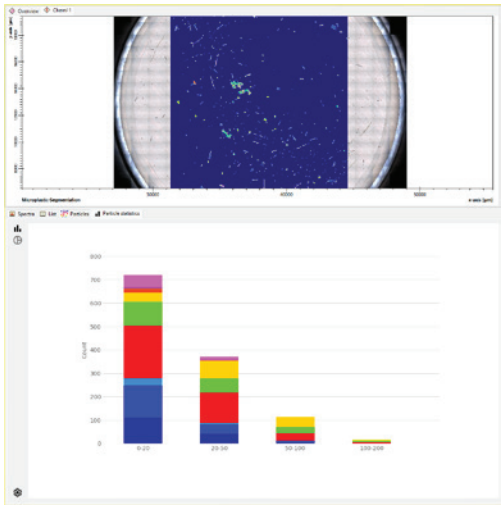
In microplastics analysis, accuracy depends as much on data interpretation as on measurement. Software is central to ensuring results are reliable, traceable, and compliant with regulations (e.g. EU 2024/1441, ISO 24187). Our solution delivers end-to-end support, from acquisition to analysis, automating evaluation and transforming raw data into a complete characterization of particles by identity, size, and distribution.

MP-ID (Infrared)

- Superior polymer classification by machine learning model
- Trained on high quality microplastic reference data
- Robust to degraded polymers and matrix impurities
- Reliably resolves agglomerates on crowded filters
- Rapid processing of full-filter datasets
- Predictable analysis times, independent of particle count

Particle Finder (Raman)

- High spatial resolution, detects particles < 1µm
- Automated with advanced measurement methods
- Creates particle average spectra via area scanning
- Particle imaging resolves agglomerates
- Real-time, live data evaluation and result creation
- Polymer ID with user-editable library



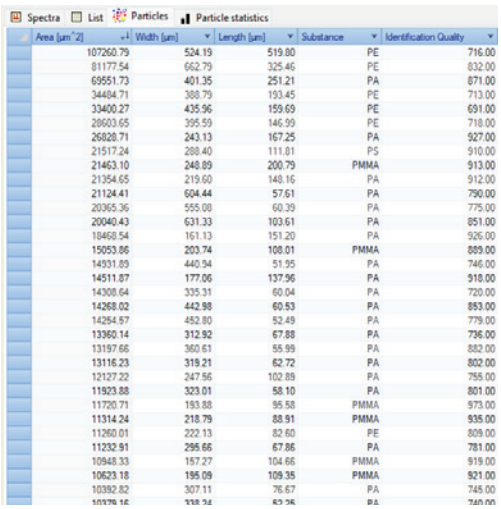


Fig. 2, MPID
Analysis of IR imaging data of a complete filter using MP-ID. Substance classes are assigned specific colors for visualization as bar or pie charts. A comprehensive list of particles, along with size, substance, and identification quality is provided.

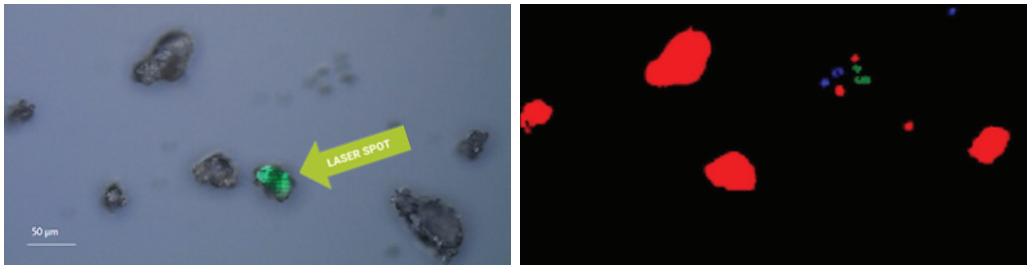


Fig. 3, Raman Averaging
Nanophoton microscopes can rapidly "flash" the laser over the complete particle surface (left), creating a representative average Raman spectrum and create a real-time chemical map (right).

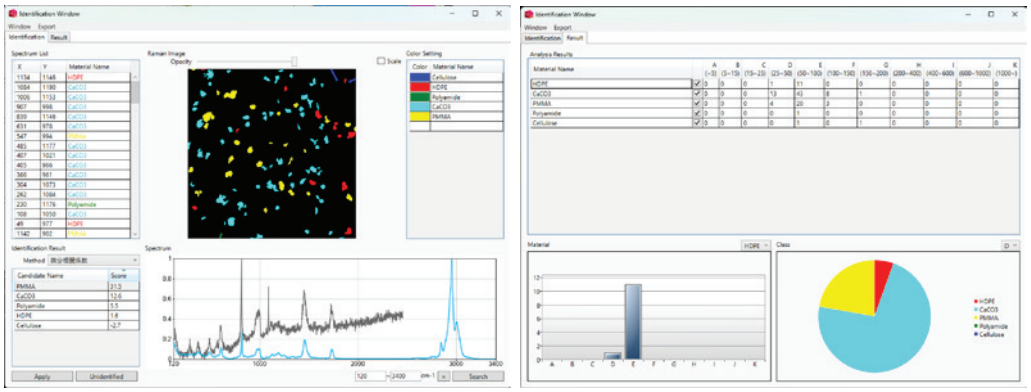
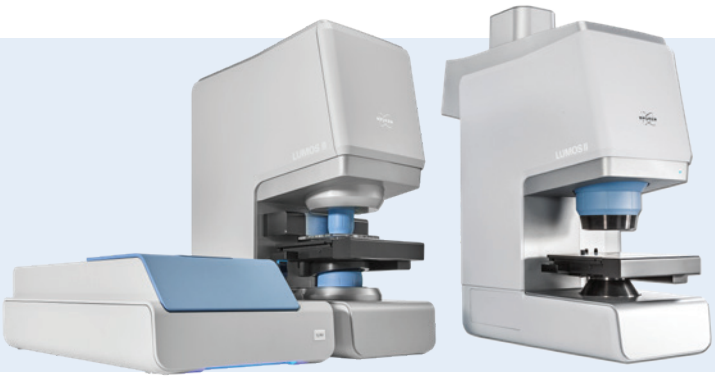


Fig. 4, Particle Evaluation
Software output showing final Raman image and according spectra (left) as well as particle statistics like identity and size (right).

The Instruments

Customers must decide whether FT-IR or Raman best fits their microplastic analysis needs. IR offers speed and robustness; Raman enables detection of particles even below 1 µm. Whichever method they choose, Bruker provides high-performance instruments trusted worldwide for reliable results.



Infrared Microscope LUMOS II

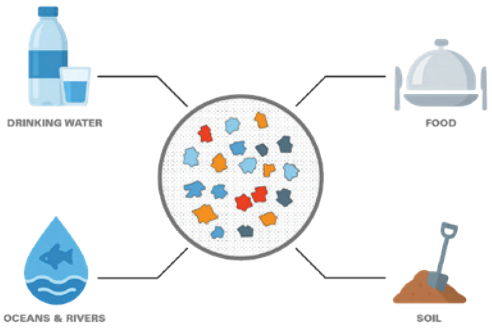
- Reliable identification of microplastics particles > 5 µm
- Routine-Ready, highly automated workflows
- Real IR imaging of complete filters
- Scalable analysis times & high sample throughput
- Brilliant IR images with large filed of view
- Choose FT-IR for full spectral coverage & superior robustness
- Choose IR laser imaging (ILIM) for ultimate sample throughput (>20 filters per day)

Raman Microscope Nanophoton RAMANtouch

- Detect particles < 1 µm
- Delivers highest visual image quality for precise localization
- Automated workflows for streamlined particle analysis
- Advanced particle average scanning for highest spectral quality
- Raman imaging resolves complex agglomerates

New to Microplastics?

Microplastics analysis must be effective, reliable and sustainable. We think communication between instrument supplier and user is crucial to achieve these goals. Our MP specialist are looking forward to learn about your specific requirements and will address your problems head-on. Together, we'll find a solution to this global environmental threat.



Trust the real Experts

For more than a decade Bruker has been at the forefront of microplastics research, supporting pioneers like the Alfred-Wegener-Institute with the best available hardware for high-throughput microplastics analysis. These are but three examples of our vast customer base.

Dr. Martin Löder
Collaborative Research Center on Microplastics, University of Bayreuth.
They use FT-IR imaging on a daily basis to reliably find and identify these particles even in complex matrices.

Dr. Sebastian Primpke
Alfred-Wegener Institute, Helmholtz centre for polar and marine research.
The AWI is currently using three Bruker systems to analyze microplastics from all over the world 24/7.

Dr. Gábor Bordós
Eurofins, a global analytical service provider, environmental analysis division.
Eurofin applies the LUMOS II in day-to-day analysis of microplastics from a variety of environmental samples.

Bruker Optics is continually improving its products and reserves the right to change specifications without notice.
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Bruker Optics GmbH & Co. KG
info.bopt.de@bruker.com

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Want to learn more?
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Bruker Optics is ISO 9001, ISO 13485, ISO 14001 and ISO 50001 certified.