Product Note M181 - 02/20

OPUS/OBJECT: Automated Particle Analysis

About the importance of particle analysis

Particle analysis is a key application of FTIR and Raman microscopy and is receiving increased attention since microplastic contamination has become an issue of public interest. New sources of microplastics are constantly being discovered and the impact on the environment and human life is discussed worldwide.

In this regard, the ubiquity of microplastic particles in oceans, drinking water, soil, and food is an enormous challenge to our environment and health. To address it, users need a suitable analysis method that identifies and quantifies all kinds of particles in a comfortable and reliable way. Bruker approaches this problem with a specific question:

How are small amounts of particles analyzed quickly and reliably on any kind of filter?

Single-point measurements are ideal for such a procedure, as only the relevant particles are considered. FTIR and Raman imaging, on the other hand, analyze the entire filter in one go, but inevitably measure a lot of "empty" filter material, resulting in large amounts of equally "empty" data.

The FTIR measurement can be performed using transmission, reflection or attenuated total reflection (ATR) with each approach having its own benefits and limitations.

The right instrument

The fully automated FTIR microscope LUMOS II is the ideal instrument for infrared analysis. It offers excellent visual and spectral quality combined with a robust and reliable design that comes in a compact format ensuring a small footprint on your workbench.

For Raman, the confocal microscope SENTERRA II is the instrument of choice combining brilliant performance with ease of use.

Straightforward software

To provide a fast and convenient workflow, Bruker's spectroscopy software OPUS includes a toolset for particle search and identification, called "Find Region" and "MP-ID".

After collecting a spatially resolved visual image of a filter, "Find Region" will automatically determine the location of particles on that filter and set the measurement points accordingly. Additional measurement points can be set freely if required.

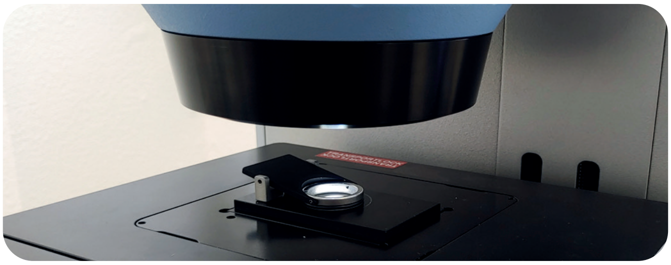

Figure 1: Holder with mounted filter for μ-FTIR analysis with LUMOS II.

Measurement example: contaminated tap water

Figure 2 and 3 show a filter sample of local tap water spiked with a small amount of microplastics. The analysis was performed completely automated, measuring point by point and delivering a single file that contains all the visual and spatially resolved spectral information.

Afterwards, the "MP-ID" function swiftly identified and quantified all measured particles. Among some other polymeric material, mainly polyamide was found, yielding valuable clues about the origin of the polymeric particles.

The method applied consists of a reference dataset of the most commonly found microplastic and filter materials, allowing the identification of the prevalent microplastic particles. Additionally, it also yields a statistical analysis of the number of particles for each type of polymer as well as a visualization of their distribution on the filter (Fig. 3 and 4).

A full-featured solution for particle analysis

MP-ID is a handy addition to the already extensive evaluation portfolio of micro FTIR and Raman spectroscopy (e.g. library search, cluster analysis, component regression).
It provides you with all the necessary functions to measure and subsequently identify and quantify particles.

If however, a plastic particle can not be identified by this basic method, Bruker offers the KIMW-Polymer and plastics IR and Raman libraries, containing a variety of verified spectra of the highest quality to identify any type of plastic.

MP-ID is not limited to microplastics. It is easily feasible to create your own methods for the identification of any kind of particle.

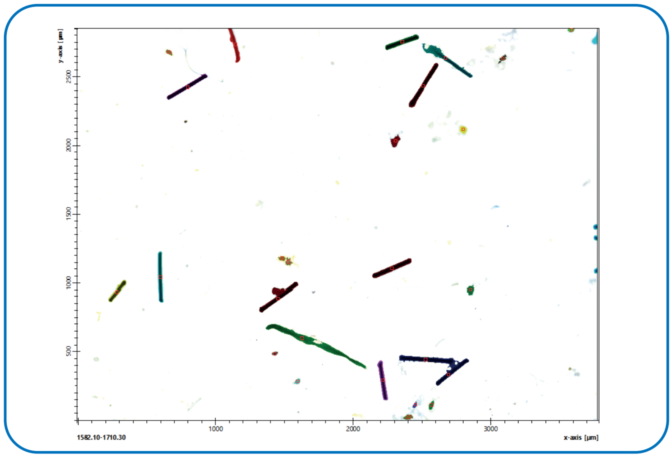

Figure 2 „Find Region" was used to locate particles (colored areas) on a filter and set measurement spots (red squares) automatically.

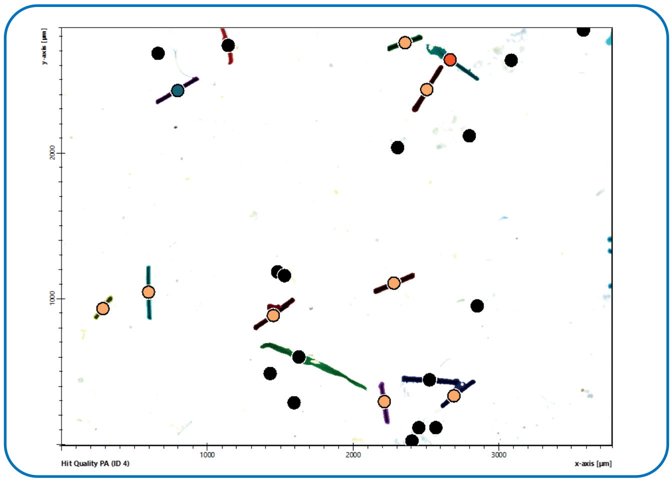

Figure 3: Distribution of microplastic particles. In this case, polyamide (PA) particles were highlighted in orange while non-PA particles remained black.

Material	0.0 µm-10.0 µm	10.0 µm-20.0 µm	20.0 µm-30.0 µm	30.0+ µm	Total Count
Unknown	0.0	1.0	4.0	2.0	7.0
Calcium carbonate	3.0	6.0	6.0	8.0	23.0
PA	0.0	1.0	0.0	1.0	2.0
PE	0.0	0.0	0.0	0.0	0.0
PMMA	0.0	0.0	0.0	2.0	2.0
Rayon	0.0	0.0	0.0	1.0	1.0

Figure 4: Automatically created list of all found plastic particles and their quantity.

OPUS/OBJECT includes:

- "Find Regions" function function for automated detection of regions with visual contrast in microscopic images (e.g. particles, fibers, inclusions) and according set of measurement positions.
- "MP-ID" particle identification statistics
- OPUS identity test including method setup.

Required:

- HYPERION and LUMOS II IR microscopes
- SENTERRA II Raman microscope