WHITE PAPER: RAMAN ANALYSIS

Combining particle size measurement and Raman analysis for detecting and identifying nano- and microplastics in liquids

A correlative method for micro- and nanoparticle detection and chemical analysis

OF2i plus Raman spectroscopy

BRAVE Analytics is part of the recently launched Nano-VISION project which focuses on detecting and identifying microplastics and nanoplastics in liquids with the goal of quantifying the amount and types of plastics in a fluidic environment.

Experimental setup

Two techniques are combined to obtain the required data:

- OptoFluidic Force Induction (OF2i) for continuous number-based particle size measurement
- Raman spectroscopy for chemical analysis

OF2i uses elastically scattered radiation to characterize particle size, particle size distributions and particle concentration. Inelastically scattered radiation can be evaluated by Raman spectroscopy and used for chemical analysis.

Combining OF2i and Raman analysis has the potential to detect particles that are too small (<500 nm) for regular Raman microscopy (the optical trapping of particles and high laser power employed by OF2i helps overcome the weak scattering inherent with small particles).

Results

Figure 1 shows the analysis of single particles using the combined OF2i-Raman technique. PS spheres with a diameter of 5 µm are trapped in the measuring cell using OF2i's optical trapping capabilities. Raman spectra were obtained from the inelastic light scattering from the trapped particles.

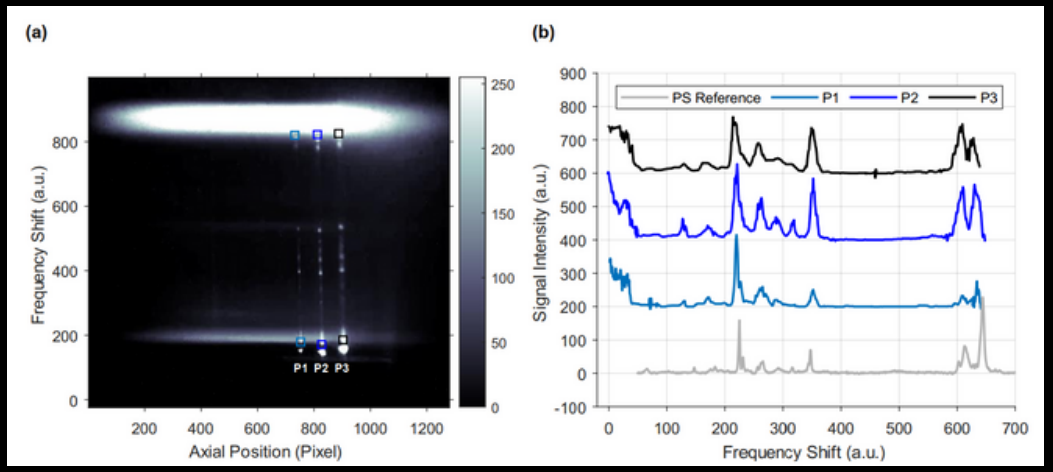

FIGURE 1: OF2i and Raman measurement of 5 µm polystyrene spheres
(a) P1 is a stably trapped single particle, P2 and P3 are agglomerations. The Raman spectra were obtained between the inserted squares
(b) The spectra of a single 5 µm particle sphere (P1), particle agglomerations (P2 and P3) and a reference spectrum of bulk polystyrene measured with a regular Raman microscope.

Conclusion

Integrating Raman spectroscopy with OptoFluidic Force Induction is feasible and a Raman module for integration into the OF2i platforms (one for benchtop laboratory analysis and one for a PAT sensor for production monitoring) is being developed.

As we have shown that Raman scattering is sufficient for identifying particles in the micrometer range, we will now concentrate on detection of microparticles and nanoparticles.