sonic**catch**
accurate measuring solutions
by usepat

An ultrasonic trap to catch small particles in liquids – In-situ Enhancement of Microplastic Raman Signal in Water Using Ultrasonic Capture

sonic**catch** enables PAT - probes to deliver accurate in-line and real-time data from streaming liquids.
Virtual sample-volumes form within seconds – the signal quality is comparable to the one of a sediment.

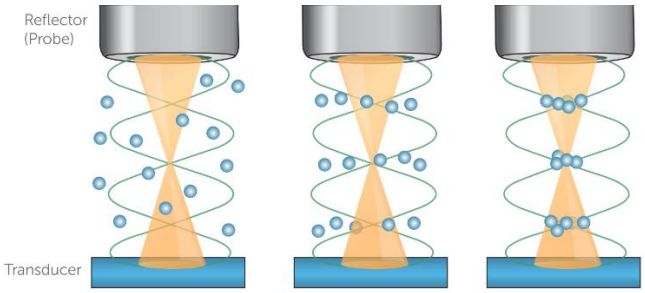
an add-on for **in-line** sensors delivering **real-time** data

soniccatch improves measurement`s

- sensitivity: improved by orders of magnitude
- selectivity: independent measurement of particles and liquid, respectively
- stability: probe stays in place, no cleaning measures necessary, no off-line sampling

In-line detection of microplastics with the help of soniccatch

The accumulation of microplastic particles in our oceans, lakes, and drinking water has gained increasing attention in recent years. Although awareness has been raised, there does not yet exist a rapid, on-site testing method with the sensitivity and repeatability needed to identify or quantify the smallest, most abundant particles. Raman spectroscopy was paired with sonic**catch** to test a new 'trap and detect' method that may prove faster, easier, and far more convenient than the current 'filter and scan' method used in most Raman-based studies of microplastics.
Testing with a 90ppm solution of 3.4 µm PMMA microspheres showed a clear and distinctive growth of the PMMA Raman signal as the particles were captured, leading to signal enhancement through ultrasonic capture of greater than 1500x.



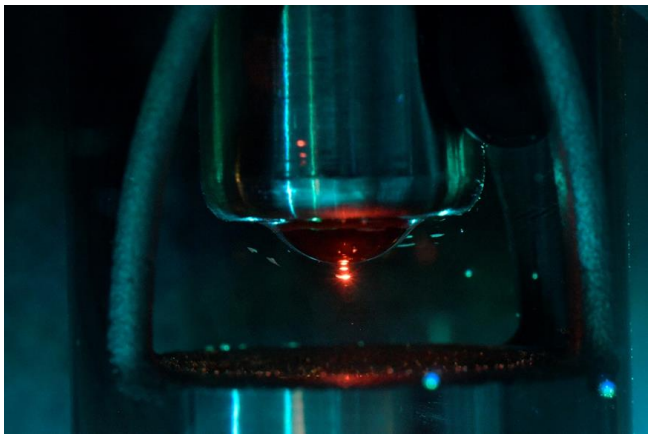


Figure 1: left: Schematic principle of ultrasonic standing wave between piezo transducer and Raman probe as the reflector capturing the particles.
*right: Raman probe applied with sonic**catch** measuring microplastics in-line*

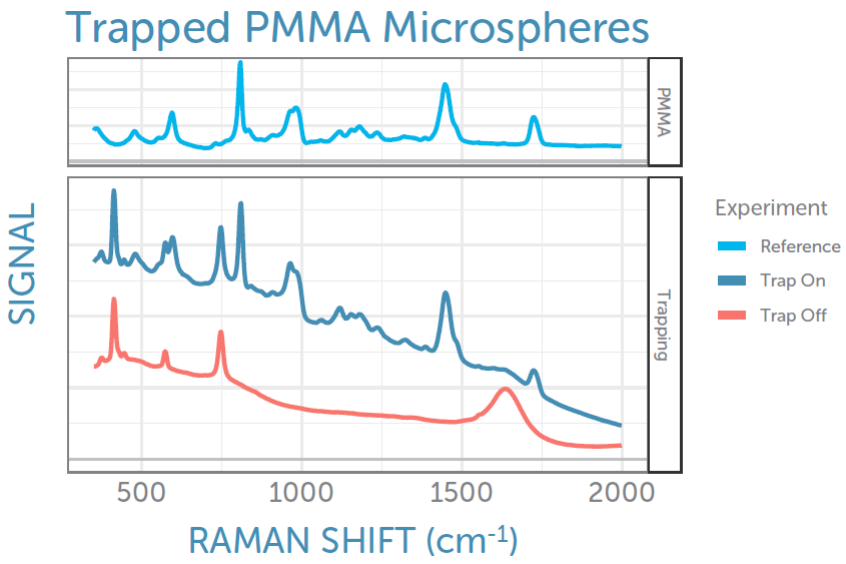


Figure 2: Bottom panel: Raman spectra of 90 ppm dispersion of 3.4µm PMMA microspheres with and without the ultrasonic trap. Top panel: Raman spectrum of neat PMMA for comparison.

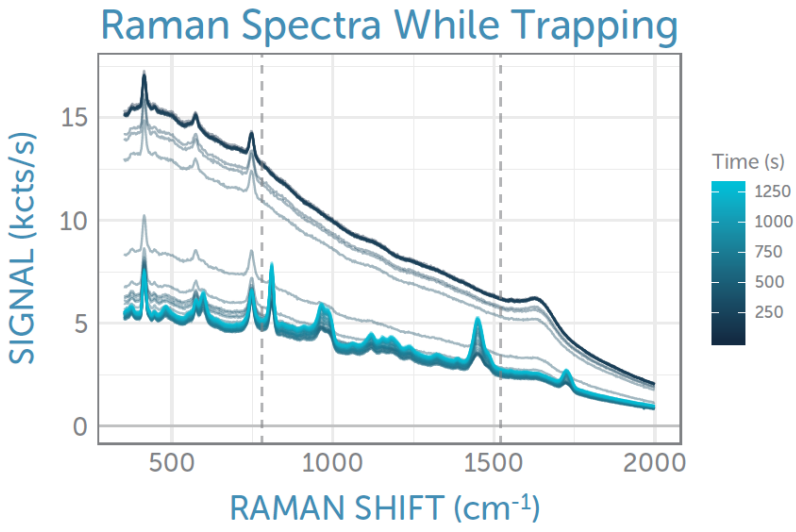


Figure 3: Evolution of dip probe spectra during ultrasonic capture. Vertical lines indicate region with main PMMA Raman lines used for baseline correction.

Comparing the Raman spectra with and without ultrasonic capture of the PMMA microspheres, as shown in the bottom panel of Figure 2, yields a contribution coming from a series of bands at ~414 cm-1, ~574 cm-1, and 748 cm-1 appearing in all spectra, constant with the ultrasonic capture. These are attributed to the sapphire of the ball probe lens. The second contribution, present in all spectra with ultrasonic capture in the steady state, agrees well with a bulk PMMA signal shown for comparison in the top panel of Figure 2, with key peaks at ~596 cm-1, ~812 cm-1, 970 cm-1, 990 cm-1, ~1450 cm-1, and ~1725 cm-1.

A direct comparison of the Raman spectra with and without ultrasonic capture to bulk PMMA in Figure 2 indicates that trapping leads to a large enhancement of the PMMA signal. The continuous evolution of the PMMA trapping in time is illustrated in Figure 3. The region associated with the main PMMA Raman lines using vertical lines was bounded just beyond 750 cm-1 and 1500 cm-1.

Dimensions
various lengths and ports
e.g. D25/ Ingold port

Materials
materials FDA compatible (1.4404 stainless, Hastelloy)

Compatibility
Successful application with:
Raman spectroscopy, midIR ATR, FBRM, in-line microscopy

Current product standard
probes up to 19mm diameter with standard product, customization possible

autoclavable

clean-in-place applicable
CIP/SIP

combinable with various measurement systems