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Optical tweezing on the inVia™ Qontor® Raman microscope

Optical tweezing uses light to hold and manipulate small particles, without damaging them. Arthur Ashkin first reported optical tweezing in 1970 and shared the 2018 Nobel Prize in Physics for “optical tweezers and their application to biological systems”.

Scientists have since used optical tweezers in many studies, including of live biological cells, organelles, phospholipid vesicles, aerosols and microplastics.

The inVia™ Qontor® Raman microscope is available with optical tweezing. An additional laser, emitting at 1064 nm, performs single beam optical tweezing. This laser is coupled to the inVia microscope via an optical fibre and does not interfere with its other capabilities.

The microscope focuses the laser to the same point as the Raman analysis laser, so you can both trap microparticles and analyse them using Raman or photoluminescence (PL) measurements.

Particle sizes

The inVia Qontor microscope’s optical tweezing performance depends on the optical properties of the particles and the medium. Typically, it can trap particles smaller than 10 µm.

1064 nm laser

A 1064 nm (infrared) laser has been selected as it is suitable for optically trapping live cells without damaging them. It also does not interfere with typical Raman and photoluminescence measurements.

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Moving particles

Once you have trapped a microparticle the laser holds it at the centre of the field of view of the microscope. You can then use the sample stage to move the particle in three dimensions through the surrounding medium.

No additional alignment required

A Renishaw engineer will align the lasers of the microscope during installation. No additional alignment is needed afterwards.

Full analysis from the inVia Qontor microscope

Optical tweezing is compatible with all visible and near infra-red Raman and PL configurations. You can even trap the microparticle and switch between these configurations automatically.

Laser shuttering

You can shutter the tweezing laser on and off from within the inVia microscope's software, making it easy to capture and release particles.

Optical trapping example

Figure 1 shows the view in the inVia Qontor microscope's software when a 1 µm diameter polystyrene sphere (in water) is trapped using a 100×/1.30 oil immersion objective. A drop of sample solution was sandwiched between a glass slide and a glass coverslip.

On the left is the optical microscope view using transmitted illumination and, on the right, a Raman spectrum of the particle taken using 532 nm excitation. You can clearly see the Raman bands of the polystyrene.

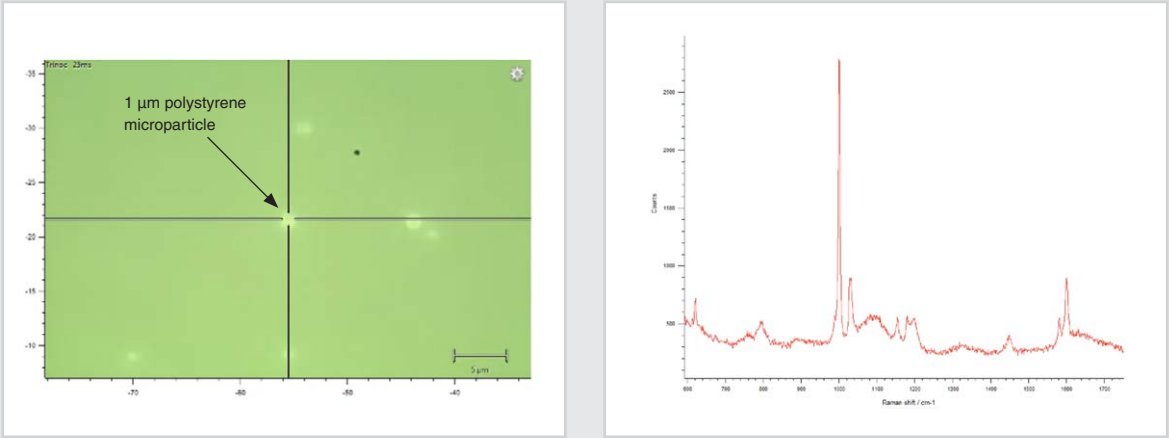

Figure 1. Optically trapped 1 µm polystyrene microparticle (left). Raman spectrum of polystyrene microparticle (right).

More research opportunities

Optical tweezing opens up many research opportunities, releasing you from the limitation of looking at deposited samples. For further details about optical tweezing on the inVia Qontor Raman microscope, contact Renishaw at raman@renishaw.com

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