



Sorby Nano Investigation Centre develops Raman Tweezers Microspectroscopy

Raman spectroscopy is a light scattering technique. Laser light produced by the microscope interacts with molecular bonds within the sample and the resulting changes in the wavelength of the light (the Raman shift) provides information of the molecular bonds within the sample.

Raman spectroscopy is information rich, it can be used for

- ☛ Chemical identification
- ☛ Acquiring chemical information of lipids, protein, DNA and other organic chemical
- ☛ Molecular structure characterisation
- ☛ In-vivo diagnose, for example, in vivo skin analysis and cancer cells
- ☛ Drug and cell imaging
- ☛ Gem and painting authenticity test
- ☛ Industrial catalyst analysis
- ☛ Material analysis, for example, semiconductor and nanoparticle analysis
- ☛ Cell identification and characterisation

Raman Microspectroscopy couples techniques of Raman spectroscopy and optical microscopy. Dr Wei Huang (Sorby Nano Investigation Centre), collaborating with Horiba Jobin Yvon (microscope manufacturers), Dr Andrew Ward (Rutherford Appleton Laboratory) and Dr Andrew Whiteley (Centre for Ecology and Hydrology) have recently integrated fluorescent and optical tweezers techniques to a Raman optical microscope, which is a unique instrument.



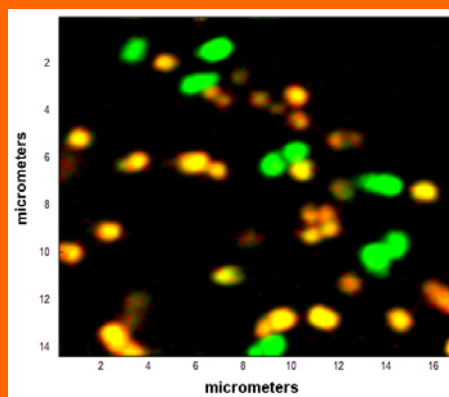
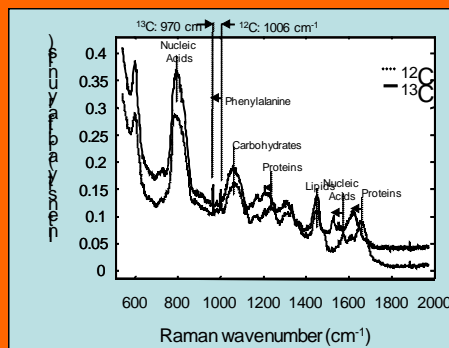


The combination of the above techniques into one instrument offers the following advantages

- ❖ Non-invasive and non-destructive analysis of samples
- ❖ Raman shifts can be collected from a very small volume (< 1 μm in diameter)
- ❖ Confocal images with X,Y and Z spatial discrimination can be collected
- ❖ Characterisation of fluorescent labelled cells
- ❖ Characterisation of cells labelled isotopes
- ❖ In-vivo manipulation of single particles or cells

Raman microscopy identifies key pollutant degraders in the environment

Bacteria which can degrade ^{13}C labelled naphthalene would integrate the label into their cellular components. Raman analysis of the cells would reveal which of these cells had metabolised the labelled naphthalene by virtue of the Raman shift. This is of particular relevance for the identification of non culturable bacteria from an endogenous soil sample population. Figure 1A shows Raman shift of labelled cells; and 1B shows Raman images of isotope labelled-cells (green) compared to cells that can not metabolise naphthalene (yellow).



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