

Resonant Mie scattering in infrared spectroscopy of biological materials – understanding the "dispersion artefact"

Paul Bassan¹, Hugh J. Byrne², Frank Bonnier², Joe Lee¹, Paul Dumas³,
Peter Gardner^{1*}

¹School of Chemical Engineering and Analytical Science, Manchester Interdisciplinary Biocentre University of Manchester, 131 Princess Street, , Manchester, M1 7DN, UK

²Focus Institute, Dublin Institute of Technology, Kevin Street, Dublin 8, Ireland

³ Synchrotron SOLEIL, L'Orme des Merisiers, BP48 - Saint Aubin,
91192 Gif-sur-Yvette Cedex, France

Infrared spectroscopy of single biological cells could potentially be invaluable in the field of spectroscopic cytology or in monitoring drug-cell interaction, associated with personalised medicine or new drug development. However, in order for the technique to be successful, practitioners must be able to extract reliably a pure absorption spectrum from a measured spectrum that often contains many confounding factors. The most intractable problem to date is the, so called, dispersion artefact which most prominently manifests itself as a sharp decrease in absorbance on the high wavenumber side of the amide I band in the measured IR spectrum. In order to successfully correct for this artefact we must first understand its origins. In this work we go back to basics and measure spectra from single isolated monodispersed PMMA microspheres. Using spheres of systematically varying size, but with identical chemical composition we have been able to model the spectral distortions arising from scattering effects. We demonstrate that the spectral distortions in the data can be understood in terms of *resonant* Mie scattering (RMieS).

References:

- [1] P. Bassan, H. Byrne, J. Lee, F. Bonnier, C. Clarke, P. Dumas, E. Gazi, M. D. Brown, N. W. Clarke, and P. Gardner "Reflection Contributions to the dispersion artefact in FTIR spectra of single biological cells" *Analyst* **134**, 1171-1175 (2009).
- [2] P. Bassan, H. Byrne, F. Bonnier, J. Lee, P. Dumas and P. Gardner "Resonant Mie scattering in infrared spectroscopy of biological materials – understanding the dispersion artefact" *Analyst* **134**, 1586-1593 (2009).