The refractive index of organic material from atmospheric aerosol measured over the visible wavelength range using optical tweezers.

ROSALIE H. SHEPHERD[1,2], MARTIN D. KING[2], ANDREW D. WARD[1], AMELIA MARKS[2] AND NEIL BROUGH[3]

[1]Central Laser Facility, Research Complex, STFC Rutherford Appleton Laboratory, Oxford, OX11 0FA, UK
[2]Department of Earth Sciences, Royal Holloway University of London, Egham, Surrey, TW20 0EX, UK

[3]British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, UK

The refractive index of organic material likely to form films was extracted from urban and remote aerosol samples as well as wood smoke and measured over the wavelength range of 460-640 nm by Mie spectroscopy whilst held in an optical trap. Refractive index values at 589 nm ranging from 1.450 to 1.588 were measured The refractive index of a commercial aqueous humic acid sample was also measured as 1.460 at 589 nm. Mie scattering spectra from the wood smoke aerosol extracts and aqueous humic acid sample were noted to have reduced intensity at lower wavelengths, which was modeled using the measured absorption Ångstrom exponent for wood smoke aerosol extracts and aqueous humic acid aerosol samples. Ångstrom exponent of 3.2 and 7.0 were measured for Humic and wood smoke aerosol respectivly. The experiments demonstrate the first application of Mie spectroscopy with optically trapped single particles derived from atmospheric samples to attain a wavelength dependent refractive index.

The organic atmospheric aerosol extracts contain potential film forming material for an organic shell and an aqueous core aerosol. Radiative transfer modeling of a core-shell system with the shell representing the three atmospheric aerosol extracts upon an aqueous core aerosol, indicated that if the atmospheric aerosol extracts formed a thin shell on an aqueous aerosol then the albedo of the top of the atmosphere may change by up to 0.03