Geophysical Research Abstracts
Vol. 21, EGU2019-16593, 2019
EGU General Assembly 2019

Self-Organisation in Atmospheric Aerosols?

Christian Pfrang

University of Birmingham, School of Geography, Earth and Environmental Sciences, Birmingham, United Kingdom (c.pfrang@bham.ac.uk)

Acoustic trapping can be used to levitate and manipulate droplets of soft matter, in particular, lyotropic mesophases formed from self-organisation of different surfactants and lipids, which can be analysed in a contact-less manner by X-ray scattering in a controlled gas-phase environment [1]. Organic atmospheric aerosols often contain both hydrophilic and hydrophobic components, but the nature of how these compounds are arranged within an aerosol droplet remains unknown. We have demonstrated [2] that fatty acids in proxies for atmospheric aerosols self-organise into highly ordered three-dimensional nanostructures that may have implications for environmentally important processes. Acoustically trapped droplets of oleic acid/sodium oleate mixtures in sodium chloride solution were analysed by simultaneous synchrotron small-angle X-ray scattering (SAXS) and Raman spectroscopy. We showed that the droplets contained crystal-like lyotropic phases including hexagonal and cubic close-packed arrangements of spherical and cylindrical micelles, and stacks of bilayers, whose structures responded to atmospherically relevant humidity changes and chemical reactions. Further experiments demonstrated that lyotropic-phase formation also occurs in more complex mixtures more closely resembling compositions of atmospheric aerosols. We suggest that lyotropic-phase formation likely occurs in the atmosphere, with potential implications for residence times and other aerosol characteristics.

References

[1] A. M. Seddon, S. J. Richardson, K. Rastogi, T. S. Plivelic, A. M. Squires, and C. Pfrang, The Journal of Physical Chemistry Letters 7 (7), 1341-1345 (2016)

[2] C. Pfrang, K. Rastogi, E. R. Cabrera-Martinez, A. M. Seddon, C. Dicko, A. Labrador, T. S. Plivelic, N. Cowieson, and A. M. Squires, Nature Communications 8, 1724 (2017).