



Oxidation of organic material at a buried interface: Cloud-climate effects and a new community cell for neutron and x-ray experiments

Supervisor(s): Martin King (Royal Holloway University of London), Becky Welbourn (ISIS pulsed neutron source) Tom Arnold (Diamond Light Source) Andy Ward (Laser Science Facility)

A fully funded 3.5-year studentship to work at the Rutherford-Appleton Laboratory in Oxfordshire with the large facilities ISIS pulsed neutron source, Diamond Light source with Royal Holloway University of London.

Project Description:

Modern climate change is strongly influenced by clouds. The oxidative processing of pollutants in clouds affects droplet size and optical properties of the cloud. Cloud droplets contain naturally occurring organic lipids which form organic films on mineral aerosols. Atmospheric oxidation and removal of this film can cause new cloud formation. Previous work has studied the oxidation reactions with proxy or model compounds. In this project, organic matter extracted from real rain water and atmospheric aerosol will be used to conclusively demonstrate that interfacial chemistry can affect cloud and rainfall, through advanced oxidation experiments at three STFC facilities. The successful candidate will work with: neutron and x-ray reflection on interfaces and laser spectroscopy of micron sized particles held by laser tweezers.

The successful candidate will work with STFC facilities: Using neutron and x-ray reflection on interfaces and laser spectroscopy of micron sized particles held by laser tweezers. Atmospheric oxidation reactions can activate atmospheric aerosol to form cloud droplets. By measuring the kinetics of the oxidation, we can calculate the atmospheric lifetime of the organic layer at the air-water interface and compare to typical aerosol lifetimes of 1-4 days. If the chemical lifetime of the organic film on exposure to an oxidative environment is less than 1-3 days, the reaction is atmospherically important and should be included in cloud modelling. The oxidation kinetics and products of the organic material at the air-water interface will be quantified by neutron (and x-ray) reflection at ISIS, ILL and Diamond. CCN activation on oxidation will be probed in experiments at the Laser for Science facility using the laser tweezers technique. The chemical systems investigated by neutrons will be studied on 1–4 μm droplets trapped and sized in the focus of a laser using Mie spectroscopy. The neutron and x-ray data will give us information on the molecular interpretation, kinetics and lifetime of these processes while the laser results will inform us about the potential impact of these parameters on cloud formation.

The student will be placed at Rutherford-Appleton laboratory in Oxfordshire and work in international laboratories with bleeding edge science techniques. The student will use neutron, X-ray, and laser facilities in the UK and in France to study the above science.

Applications from students with a good upper second class degrees or better in chemistry, physics or engineering (or related subjects) are encourage to apply. You will receive training in atmospheric science, scattering science and the use of large facilities and develop strong skills in experimental science, scattering and potentially atmospheric modelling, with potential field trips to collect atmospheric samples. You will be expected to attend international conferences. Your thesis will be written up by concurrent publication (i.e.

scientific papers) and you will finish your PhD with scientific publications. The position would suit a motivated individual who can work well with others in collaborative science, your supervisors are all expert in the different aspects of the work.

Interested – please contact Martin King (01784 414048, m.king@rhul.ac.uk) for further discussions.

Eligibility for this studentship is restricted to UK citizens and applicants who have been ordinarily resident in the UK throughout the 3-year period preceding the date of application for an award, and has settled status in the UK within the meaning of the Immigration Act 1971 (ie is not subject to any restriction on the period for which he/she may stay). Further information can be found from the Science Technology Facilities Research Council.

Details on how to apply can be found here www.rhul.ac.uk/studyhere/postgraduate/applying

Please contact the Postgraduate Programmes Co-ordinator, if you have additional questions about the department or application procedures (email: pgadmin@es.rhul.ac.uk ; fax: 01784-471780; tel: 01784-443581).

Applicants are requested to send an additional copy of their CV directly to the lead supervisor of the project in which they are interested. Please also contact the supervisor if you have any questions about the project itself