

PhD Studentship

London Centre for Nanotechnology
University College London

PhD STUDENTSHIP IN IONIC LIQUID IRRADIATION

UCL EPSRC DTP award

Applications are invited for a fully funded EPSRC DTP PhD Studentship to work with Dr Carla Perez-Martinez (London Centre for Nanotechnology) on Ionic Liquid Irradiation.

The studentship will cover Home tuition fees and an annual stipend of no less than £17,285 increasingly annually with inflation. The studentship is funded for 4 years on a full-time basis, or up to 8 years on a part-time basis. Part-time stipend figures are pro-rata.

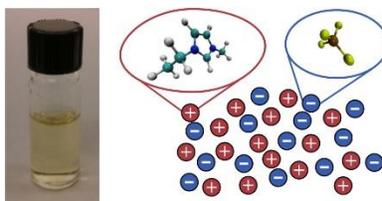
The successful applicant is expected to start in September/October 2021.

Studentship Details

The student chosen for this position will implement an **irradiation system for treatment of materials using ionic liquids**.

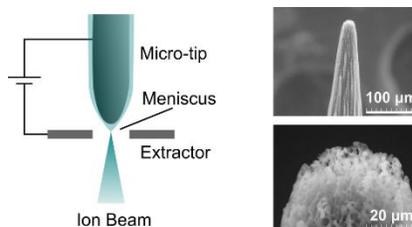
Our research is based on **Ionic Liquid Ion Sources (ILIS)**. ILIS are electrospray devices that produce ion beams by means of field evaporation from ionic liquids.

Ionic liquids are room temperature molten salts, or mixtures of cations or anions that are liquid at room temperature with no intervening solvent. You can think of it as a plasma in a bottle. The cations are usually large organic molecules, while the anions may be complex organic or simple inorganic ions.



Example of an ionic liquid, 1-ethyl-3-methylimidazolium tetrafluoroborate.

In ILIS, a **needle emitter is covered with ionic liquid** and biased to a high voltage with respect to a downstream metallic extractor. The electric field causes the liquid to deform into a sharp meniscus. At the apex of the meniscus, the electric field is high enough to trigger evaporation of ions from the liquid. **The resulting beam can be used to treat materials. With hundreds of ionic liquids available, it is possible to produce ions ranging from halogens to kilodalton organic species. Reactive ions could be used for fast etching of silicon, while heavier species could be used for surface smoothing.**



ILIS schematic, and scanning electron micrograph images of an ILIS emitter tip.

Previous studies reveal that the ion beams from ILIS do not contain a single type of ion, but several types of particles. For material treatment applications, it is desired to use only a specific type of ion.

In this project, the student will:

- Refine the design of a Wien filter for separation of different ion species contained in the beam.
- Construct and implement this Wien filter in a vacuum chamber.
- Test the filtering system with ILIS, using techniques such as time-of-flight spectrometry and retarding potential analysis to determine the composition and energy distribution of the beam.
- Irradiate samples of different materials, including semiconductors and biological substrates, and evaluate the result of irradiation using profilometry, atomic force microscopy, and x-ray photoelectron spectroscopy.

Eligibility

Suitable candidates for this post will have a minimum of an upper second-class UK integrated Master's (MSci or MPhys) degree in physics, electrical or electronic engineering, materials science, or a related discipline, or an undergraduate degree followed by an MSc in a one of the relevant disciplines, or an overseas qualification of an equivalent standard.

We value a candidate with the desire to learn, create and innovate. Any experience with complex experimental setups, Labview, or surface analysis techniques, would be advantageous.

Applicants must meet the EPSRC eligibility conditions to be eligible for the award – in summary this typically means that applicants must have no restrictions on their right to live in the UK permanently and have been resident in the UK for three years immediately prior to the studentship commencing. There is limited flexibility to offer awards to those who don't meet the EPSRC eligibility criteria, however note that the award covers Home tuition fees only. Please see [EPSRC's](#) and [UKRI](#) websites for further details,

Apply

Interested candidates should submit a supporting statement, a full CV (including contact details for at least two academic referees) and a copy of transcripts to-date via the [PhD Portal](#).

The supporting statement should clearly state the name of the project you are applying for at the top, and outline your interest in and suitability for, researching the suggested topic. On the application form, you do not need to complete the "Layman Summary" question, please just indicate the name of the project in this section instead. Referees will be contracted separately, so you do not need to supply references at the point of application. You will need to tick the box on the PhD Portal application form indicating this.

Successful candidates will be invited to submit a formal application for admission to UCL.

The closing date for applications is **31 December 2020**, and interviews will be held in early January 2021. The project will commence in September/October 2021. Any inquiries or further information about the studentship should be emailed to carla.perezmartinez@ucl.ac.uk.