PhD studentship - Using Ionic Liquid Ion Sources for Focused Ion Beam applications: Investigating the fundamentals

Astronautics Group, Department of Aeronautics and Astronautics, University of Southampton, UK

Duration of studentship: 3.5 years

Funding: For UK students, Tuition Fees and a stipend of £15,609 tax-free per annum for up to 3.5 years. For overseas students, the above is available, with further negotiation on overseas tuition fees dependent on quality of applicant.

Start of post: October 2021, but can be flexible up to March 2022 with good applicant.

Applications are invited for a PhD studentship within the Astronautics Group, in the Department of Aeronautics and Astronautics, University of Southampton, UK, investigating the fundamentals of the emission process from ionic liquid ion sources.

Gallium Liquid Metal Ion Sources (LMIS) are the standard choice for ion beam material etching, facilitating ion beam lithography as the go-to technique for in situ microfabrication. Many microfabrication applications would benefit though from a more flexible ion beam source, with different ion beam species significantly influencing the physical and chemical nature of the milling results, for example reducing ion implantation or enhancing etching through using chemically reactive ions.

One such option is Ionic Liquid Ion Sources (ILIS), where rather than extracting ions from a liquid metal such as gallium, ions can be extracted from an molecular ionic liquid. Through the use of Ionic Liquids, there is a far greater choice of ion type that can be emitted, across a much larger range, offering the ultimate flexible ion source.

Recently there have been great improvement in the operation of ILIS's through the development of their use for ion thrusters for spacecraft. Our research group at Southampton has developed an electrospray ion thruster for micro spacecraft propulsion. This project will develop this thruster for application as an ILIS for Focused Ion Beam etching of materials.

The PhD will investigate the fundamentals of ion emission from an Ionic Liquid Ion Source, investigating the properties of the beam using various diagnostic techniques, using the excellent facilities at the David Fearn Electric Propulsion Laboratory:

https://www.southampton.ac.uk/engineering/research/facilities/analytical_facilties.page

The PhD studentship will focus on experimental investigating fundamental aspects of ILIS's. Particular emphasis will be put on gaining insight into the ion emission process, the use of novel ion liquids, and the imaging of the ion emission source.

The PhD is part of a large EPSRC funded project:

https://gow.epsrc.ukri.org/NGBOViewGrant.aspx?GrantRef=EP/V04995X/1

The project is a collaboration between the Astronautics Group at the University of Southampton, through Dr Charlie Ryan, and the Optoelectronics Research Group, through Dr Oleg Buchnev. The PhD will have unique access to both the Electric Propulsion Laboratory, and the world class clean room of the ORC;

https://www.orc.soton.ac.uk/facilities

The PhD will be supervised by Dr Charlie Ryan and Dr Oleg Buchnev, and will be joining Dr Charlie Ryan's strong group of five PhD students are two post-docs working on various applications of ion beams;

https://www.southampton.ac.uk/engineering/about/staff/cnr1e15.page

As part of the project, the PhD is part sponsored by Thermo Fisher Scientific, one of the world leaders in the development of focused ion beam technology. The PhD student will be working closely with their primary FIB R&D team, and with the EPSRC funded project team in general.

Entry Requirements: a very good undergraduate degree (at least a UK 2:1 honours degree, or its international equivalent).

Closing date: 31 August 2021.

If you are interested in this position, further information and the application procedure can be found here:

https://jobs.soton.ac.uk/Vacancy.aspx?ref=1467521DA

For informal enquiries, please contact Dr Charlie Ryan, Assistant Professor in Astronautics, University of Southampton, UK. c.n.ryan@soton.ac.uk.