Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Two-year Postdoctoral Research Position in
Experiments and Modelling of Electrochemical Reduction of Carbon Dioxide

Salary of €38,417 per year.

A position is available in the research team of **Prof. Stephen Dooley** at the **School of Physics Trinity College Dublin, in collaboration with Prof. Kim McKelvey** at the **School of Chemistry Trinity College Dublin** supported by **the Sustainable Energy Authority of Ireland**. The project investigates the physical and chemical processes controlling the selective electrochemical catalysis of carbon dioxide to methanol by the creation of an advanced multi-physics simulation.

Background: Electricity-to-Fuels, in which electrical energy generated from renewable sources is used as energy source for the synthesis of fuels from carbon dioxide (CO_2) and water, is a technology that could interrupt the anthropogenic carbon cycle and significantly reduce net greenhouse gas emissions as required by the 2016 Paris Climate Agreement. Electricity-to-Fuels technologies (also known as *Power-to-X* or *Electro-fuels*) are fast-evolving but face several fundamental science challenges in their operation and market viability. Particularly, the production costs of an Electricity-to-Fuels approaches are highly dependent on the capital costs of the electrolyser and the electricity price. The design of the electrolyser is thus critical.

Project: This project will provide an experimental and computational platform with which to test, model, and optimise the performance of CO_2 electrolysis cells. A sophisticated multi-physics simulation of a CO_2 electrolysis cell will be developed, incorporating electrochemical reaction kinetics, fluid mechanics, and transport of chemical species.

Role: A postdoctoral researcher is sought to join the research team comprising two Principal Investigators and two dedicated post-graduate students. With the other team members, the successful candidate will:

- Design and construct a CO_2 electrolysis cell and characterisation facility.
- Characterise the operation of the CO_2 electrolysis cell in a number of different electrolyte, electrode and operating parameter configurations.
- Contribute to development of a multi-physics simulation to describe the essential physical processes occurring in the cell in the form of an open-access numerical model.
- Analyse the multi-physics simulation to identify performance limitations, propose design modifications, and computationally optimise cell design to improve performance.
- Contribute to identification and engagement with relevant industry and societal stakeholders.
- Contribute to day-today supervision of two PhD students.
- Lead report, scientific paper and IP writing.
- Lead the delivery of oral research presentations at international conferences.

Research Environment: You will work in a close collaboration with both Dr. Stephen Dooley and Dr. Kim McKelvey. You will be part of a supportive research group in the School of Physics at Trinity College Dublin. Research will be primarily undertaken at Trinity College Dublin. The School of Physics at Trinity College Dublin offers a vibrant research community with world-class research facilities. You will have opportunities to interact with other research groups within Trinity, Ireland and Internationally. Your professional development is important to us. You will receive specific training; in communication, project management and reporting appropriate for the remote-age; the commercialising of your research; the engagement of industry actors, supervision and management, and other areas of importance to your career.

Essential Requirements: The successful application will have:

- A PhD in Chemistry, Physics, Chemical Engineering or related field.
- Knowledge of electrochemistry or electrocatalysis

- Experience in the design and operation of electrolysis cells.
- Skills and experience of impedance spectroscopy and other electrochemical current-voltage characterisation techniques.
- Excellent communication skills

Advantaged Requirements: Skills and experience in the following will be a definite advantage:

- Experience with the use of simulation techniques for the physics-based modelling of electrochemical reactions and transport processes, application of machine learning tools, construction of partial/ordinary differential equations.
- Good working knowledge of MATLAB, COMSOL, Python.
- Knowledge of catalysts for CO_2 electrochemical reduction and of high surface area materials for electrode design.

Application: Prospective candidates should send a two-page CV, a covering letter outlining their educational background, research track-record, interest in the position and the names and contact details of two referees to Prof. Stephen Dooley (stephen.dooley@tcd.ie). Please quote the entire job title in the subject line of your email. The 24-month position is available immediately. Applications will be evaluated as received and candidates of all levels of experience possessing appropriate skillsets will be considered.

The School of Physics, Trinity College Dublin has been awarded Institute of Physics Juno Practitioner and Athena SWAN Bronze Award status for taking action to address gender inequities across its student and staff body. It is committed to promoting better working practices for men and women. See https://www.tcd.ie/Physics/womeninphysics/. The School welcomes applications from all qualified applicants, and applications are particularly encouraged from traditionally under-represented groups in Physics.