PhD Studentship
Dr. Katharina Brinkert

PhD project: Performance Modelling of Photoelectrochemical Devices in Reduced Gravitational Environments
Supervisor: Dr. Katharina Brinkert (University of Warwick)/ Dr. Sophia Haussener (EPFL/ Switzerland)
Funding availability: Awaiting Funding Confirmation.
Deadline: 1st July 2021

Project description:
Photoelectrochemical devices integrate the processes of light absorption, charge separation and catalysis and are therefore an interesting complement to currently existing life support systems for the realization of long-term space missions and surface habitats on Moon and Mars due to significant advantages of reduced weight and volume in comparison to traditionally employed electrochemical cells powered by PV. The application of (photo-)electrochemical devices in reduced gravitation is however challenged due the absence of buoyancy which causes hindered gas bubble release from the electrode surface and mass transfer limitations of reactants and products to and from the electrode surface. In this joint PhD project between the University of Warwick/UK and EPFL/Switzerland and co-funded by the European Space Agency (ESA), we will investigate the impact of reduced gravitation on the performance of photoelectrochemical devices i.e., the oxygen evolution reaction (OER), the hydrogen evolution reaction (HER) and the CO$_2$ reduction reaction. Employing theoretical model systems using ideal semiconductor-electrocatalyst systems based on tandem- and triple junction cells possessing ideal solar-to-hydrogen (STH)/CO$_2$-to-hydrocarbon efficiencies, we will simulate the impact of reduced gravitation in terms of hindered gas bubble detachment from the electrode surface, reduced light absorption of the semiconductor as well as increased ohmic resistances in proximity of the electrode surface and mass transfer limited/diffusion controlled electrode reactions. The gained insights in these model systems will guide the process design of efficient and stable photoanodes and -cathodes for OER, HER and CO$_2$ reduction as well as optimal electrolyte compositions for application in terrestrial and reduced gravitational environments.
The project will be based at the University of Warwick, but includes frequent travels to EPFL and ESA.

Requirements:
Applicants should have an honours degree (at least II.1 or equivalent) in chemistry, or other relevant discipline, and should be a UK citizen or have been a resident in the UK for three or more years. Experience in computational chemistry, fluid dynamics and/or (photo-)electrocatalysis are an advantage for this project.

How to apply:
Please submit direct informal enquiries and requests for further information as well as your application including your CV, transcript, publication(s)/publication draft(s) (if available) and a personal statement to Dr. Katharina Brinkert, katharina.brinkert@warwick.ac.uk.

Details on the formal application procedure can be found at http://www.go.warwick.ac.uk/pgapply