Open Internship in the ESA Advanced Concepts Team in 2017

on

Photoelectrochemical induction of oxygen and hydrogen bubble formation studied by in-situ e-chem AFM

Stage topic description

Artificial photosynthesis systems, which follow the concept of the Z-scheme of natural photosynthesis, are presently being realized as catalyst-functionalized photovoltaic tandem devices for the photoelectrochemical oxidation of water and the simultaneous generation of hydrogen as a so-called “solar fuel”. Studies of the oxygen and hydrogen gas bubble formation in these systems are crucially important to optimize the design of solar-driven water-splitting devices for earth and space applications. In this project, the stage investigates the light-induced gas bubble formation on p-type InP electrodes covered with Rh-particles in in-situ electrochemistry/AFM experiments. Here, it is of interested to study the gas bubble evolution behaviour at various applied potentials to conclude about the growth of the bubbles and preferred nucleation sites.

Candidate's tasks

- The applicant should carry out the in-situ AFM measurements on the p-type InP electrodes in a provided photoelectrochemical set-up.

The ideal candidate

Mandatory:

- B.Sc. in Chemistry, Physics or a related discipline (preferred M.Sc.)
- Basic (preferably advanced) knowledge in electrochemistry and physical chemistry
- Interest in artificial photosynthesis and solar fuels

Desirable:

- Experience with Atomic-Force Microscopy

References

[1] Fang et al. (2016). "Nucleation processes of nanobubbles at a solid/water interface", *Nature, Scientific Reports* 6 : 24651, DOI: 10.1038/srep24651.

[2] Walczyk et al. (2013). "The effect of PeakForce tapping mode AFM imaging on the apparent shape of surface nanobubbles", *J. Phys. Condens. Matter* 25, 184005, DOI: 10.1088/0953-8984/25/18/184005.

[3] Lewerenz et al. (2010). "Photoelectrocatalysis: Principles, Nanoemitter Applications and Routes to Bio-inspired Systems", *Energy & Environm. Sci.* 3, 748, DOI: 10.1039/B915922N.

[4] Parkinson, B. & Turner, J. in: "Photoelectrochemical Water Splitting: Materials, Processes and Architectures", eds. Lewerenz H.-J., Peter L. Ch. 1, 1-18, The Royal Society of Chemistry (2013).