



Seminar announcement

Thursday, June 22, 2023

1 pm

WSI, Seminar room S 101

“Electrochemistry at the atomic scale”

Electrochemistry is at the heart of many important industrial processes or systems, ranging from electrolysis and hydrogen evolution over corrosion, metal deposition up to batteries, fuel cells and photoelectrochemical devices. Here, the interface between the electrolyte and the electrode, which can be considered the site where electrocatalytic processes occur, is of particular interest. Due to its complexity and multi-component environment even after many decades of research, our understanding of the properties of this interface is still scarce. In this talk we will discuss how modern theoretical multi-scale methods in conjunction with in-situ experiments on well-defined model systems is capable to unravel the structure and composition of these interfaces as well as the ongoing electrochemical processes.

We will concentrate on metal-ion based energy storage systems, including Li-ion and Mg-ion batteries. In our experimental work we concentrated on realizing and investigating the deposition of these metal ions on model electrodes in order to understand apparent nucleation and growth processes (e.g. dendrite formation/growth). By combining different in-situ structure sensitive techniques we could resolve the initial stages of dendrite formation, which we believe is prerequisite to avoid or control their appearance [1]. The experimental work was accompanied with corresponding theoretical studies [2] on the self-diffusion on transition metal electrodes, battery-relevant materials and finally the dynamics of alloy-based electrocatalysts under operation conditions, showing the importance and urgent need for in-operando experimental studies. Further, we will discuss our recent work on understanding plasma-electrochemical systems and how plasmas are capable to alter the structure and properties of materials [3].

[1] Berger, C.; Cebelin M.; Jacob T., *ChemElectroChem* 2017, 4, 261.

[2] Gaißmaier, D.; Fantauzzi, D.; Jacob T., *J. Chem. Phys.* 2019, 150, 041723.

[3] Menezes, P.V.; Elnagar, M.M.; Eckl, M.; Al-Shakran, M.; Menezes, P.W.; Jacob, T., *Adv. Funct. Mater.*, DOI: 10.1002/adfm.202107058

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