FAKULTÄT FÜR CHEMIE

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„X-ray Photoelectron Spectroscopy in electrochemistry research – how to close the pressure gap“

Electrochemical reactions occur at the electrode/electrolyte interface. In order to understand the manifold reactions taking place at that interface, the development and application of analytical tools probing this interface in situ in an electrochemical cell are of outmost importance. Although, X-ray Photoelectron Spectroscopy (XPS) is widely accepted to be a powerful tool to study electrochemically induced changes of electrode surfaces, it can usually not be applied in situ as common electrolytes evaporate into the ultrahigh vacuum (UHV). Therefore, the so-called electrode emersion technique was established, which can be described as a quasi in situ analysis of the electrode/electrolyte interface [1]. However, all these measurements require the critical step of electrode preparation and subsequent transfer from ambient pressure to vacuum.

Unlike common electrolytes, ionic liquids (IL) provide the unique opportunity to overcome this issue, as these electrolytes are UHV compatible [2]. IL are also known to provide large electrochemical stability windows making them attractive for electrochemical applications such as electrochemical double layer capacitors or lithium ion batteries. During my talk I will present quasi in situ [3] and in situ [4] electrochemical XPS setups and discuss the opportunities and limits of both approaches with respect to investigations of interfacial behaviour, stability windows of IL, and interpretation of XPS data.

[1] D.M. Kolb, D.L. Rath, R. Wille, W.N. Hansen, Ber. Bunsenges. Phys. Chem. 87, 1108 (1983)
[2] A. Foelske-Schmitz, D. Weingarth, R. Kötz, Surf. Sci. 605, 1979 (2011)
[3] A. Foelske-Schmitz, D. Weingarth, R. Kötz, Electrochim. Acta 56 1032 (2011)
[4] D. Weingarth, A. Foelske-Schmitz, A. Wokaun, R. Kötz, Electrochem. Commun. 13 619 (2011)

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