"DEMS as a tool for surface electrochemistry, electrocatalysis and metal air batteries"

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The detailed elucidation of the structure of the interface between an electrode and an electrolyte is of ongoing concern. Surface reactions, e.g. poisoning of the catalytically active surface involve only very small amounts of substances (in the sub-nmol/cm²) range and therefore require highly sensitive surface analytical techniques.

I will demonstrate that differential electrochemical mass spectrometry (DEMS) is indeed sensitive enough to detect desorption of such small quantities even from single crystal surfaces, both in aqueous and non-aqueous electrolytes. As examples, the adsorption of benzene and carbon monoxide will be discussed. Here, and also in the elucidation of current efficiencies during faradaic reactions such as methanol oxidation at Pt or waste treatment at BDD (boron doped diamond), a quantitative determination of the amounts of products formed is necessary and helps to understand the role of co-catalysts and surface structure. In the context of metal air batteries, DEMS is important to determine the true faradaic efficiency of oxygen reduction and evolution from e.g. peroxide already in the initial stages of charging/discharging.

Various cell types have been developed for different applications; advantages and disadvantages will be discussed.