In-situ Potential-induced Surface Studies of PtRu-alloyed Catalyst in DMFC by NAP-XPS

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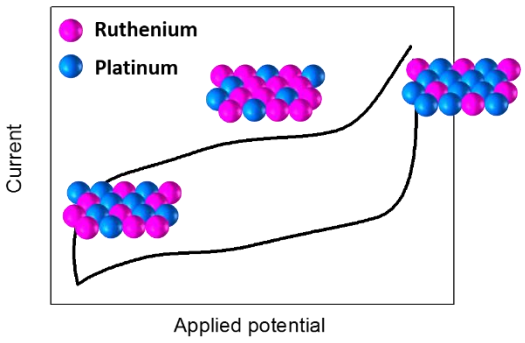

Potential-induced Ru and Pt surface segregation

Direct methanol fuel cell (DMFC) technology based on proton exchange membranes (PEM) possesses a number of advantages for off-grid applications. Due to their enhanced activity Pt-Ru alloys are the state-of-the-art anode catalysts for DMFCs. The mechanism of methanol oxidation reaction on Pt and Pt-Ru alloy surfaces has been investigated for decades. The promotional effect of Ru is attributed to a bi-functional mechanism and a ligand effect[1]. Despite considerable progress in the understanding of the reaction mechanism, the potential dependence of the Pt-Ru alloy surface composition and the oxidation state of Ru under the reaction conditions are still debated[2,3]. In this work the synchrotron-radiation-based (BESSY II, HZB) near-ambient pressure X-ray photoelectron spectroscopy (NAP-XPS) was applied for in-situ investigation of the Pt-Ru alloy (1:1) electrode/PEM interface under DMFC conditions. The analysis of the XP spectra at different photon energies (depth profiling) revealed potential-dependent Ru or Pt surface segregation. In situ measurements of the potential-induced changes in the oxidation states of Ru combined with the analysis of carbon-containing adsorbates shed new light on methanol electrocatalysis over PtRu alloys.

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