Tuning the Activity of Pt(111) for Oxygen Electroreduction by Subsurface alloying - DTU Orbit (07/01/2019)

Tuning the Activity of Pt(111) for Oxygen Electroreduction by Subsurface Alloying

To enable the development of low temperature fuel cells, significant improvements are required to the efficiency of the Pt electrocatalysts at the cathode, where oxygen reduction takes place. Herein, we study the effect of subsurface solute metals on the reactivity of Pt, using a Cu/Pt(111) near-surface alloy. Our investigations incorporate electrochemical measurements, ultrahigh vacuum experiments, and density functional theory. Changes to the OH binding energy, $\Delta E_{\text{OH}}$, were monitored in situ and adjusted continuously through the subsurface Cu coverage. The incorporation of submonolayer quantities of Cu into Pt(111) resulted in an 8-fold improvement in oxygen reduction activity. The most optimal catalyst for oxygen reduction has an $\Delta E_{\text{OH}} \approx 0.1$ eV weaker than that of pure Pt, validating earlier theoretical predictions.

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