# Adsorption and catalysis on Pt and Pd monolayer-modified Pt single crystal electrodes

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# Propositions

accompanying the thesis

# Adsorption and Catalysis on Pt and Pd Monolayer-modified Pt Single Crystal Electrodes

1. The successful deployment of advanced energy-conversion systems depends critically on our understanding of the fundamental bonding interactions at the electrified metal-liquid interfaces.

   Strmcnik, D. *et al. Nat. Chem.* **1**, 466 (2009).

2. The combined experimental and computational results provide the clearest evidence to date that the traditionally known ‘hydrogen region’ of polycrystalline platinum electrode is rather a ‘hydrogen-hydroxyl-cation’ region.

   *Chapter 2 of this thesis*

3. The co-adsorbed alkaline cations ($Li^+$, $Na^+$, $K^+$, $Cs^+$) along the step sites weaken the hydroxyl adsorption at the step sites, causing the non-Nernstian pH shift of the step-related voltammetric peak of the Pt electrode.

   *Chapter 2 and 3 of this thesis*

4. The electrochemistry of atomic well-defined Pd surface is not sufficiently studied like Pt, which is partially due to the difficulty to prepare Pd single crystal, as well as the fact that palladium absorbs substantial amounts of hydrogen below 0.2 $V_{RHE}$, masking other reactions potentially taking place.

   *Chapter 4 of this thesis*

5. Theoretically, for a two-electron transfer reaction such as the conversion between formic acid and carbon dioxide, reversible catalysts with very low overpotential must exist, and palladium-based electrocatalysts seem to approach this ideal situation.

   *Chapter 5 of this thesis*

6. A Levich behavior of formic acid oxidation on Pd monolayer decorated Pt(100) electrode sets a catalytic benchmark for direct formic acid fuel cells.

   *Chapter 6 of this thesis*

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