Lead underpotential deposition for the surface characterization of silver ad-atom modified gold electrocatalysts for glucose oxidation

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Lead Underpotential Deposition for the Surface Characterization of Silver Ad-Atom Modified Gold Electrocatalysts for Glucose Oxidation

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Abstract:

The surface composition of Ag–Au electrocatalysts plays an important role in enhancing their activity for glucose oxidation. In this work, the surface of a polycrystalline Au electrode was modified through underpotential deposition of Ag (Ag_{upd}) and the surface composition of the resulting Ag_{upd}-modified Au catalysts was characterized using an *ex situ* electrochemical technique involving underpotentially deposited lead (Pb_{upd}). Recognizing that Ag and Au surfaces exhibit distinct Pb_{upd} charge densities, the Pb_{upd} charge density associated with a Ag ad-atom modified Au electrode surface is a representation of its surface composition. This enables quantification of the Ag and Au fractional surface coverages, which are in good agreement with those predicted based on the Ag_{upd} charge density passed during Ag_{upd}–Au surface preparation. The dependence of the glucose oxidation kinetics on the surface composition of the Ag_{upd}–Au catalyst was investigated using voltammetry. Optimal catalytic activity was provided by catalysts with 56% Ag_{upd} coverage. Our investigation, while providing a reliable analytical technique (using Pb_{upd}) for compositional characterization of heterogeneous catalyst surfaces, supports the surface composition dependence of the activity of Ag_{upd}–Au catalysts toward glucose oxidation.

***Keywords*:** Silver-gold catalyst, lead underpotential deposition, glucose oxidation