Abstract ID : **58**

Surface compositional dynamics in PtNi bimetallic alloy under reaction conditions: Electrochemical and NAP-XPS Study

Content

Platinum-based bimetallic alloys are known to possess unique activities exceeding those of pure platinum. Nevertheless, as a complex multi-component system, it suffers from structural reorganization under operating conditions, strongly affecting its lifetime performance. This work provides an in situ electrochemical and spectroscopic study of the surface composition changes in a PtNi catalyst during repetitive oxidation/reduction cycles representing inherent working conditions for numerous redox reactions. Using cyclic voltammetry and near-ambient pressure X-ray photoelectron spectroscopy, a quantitative surface characterization under both realistic environments, i.e. electrified liquid and gaseous at elevated pressure and temperature, is obtained and correlated. We observed that, regardless of the operating environment, the PtNi undergoes a significant and irreversible change in composition profile reflected in surface nickel enrichment and consequent catalyst deactivation, exemplary confirmed using methanol electrooxidation reaction.

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Track Classification: Electrochemistry/electrocatalysis