Dissolution of Organic Overlayers Modified Platinum Single Crystal Interfaces in Acidic Medium

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In the focus of direct modulation on electrocatalysis interfaces, the functionalization of metallic catalysts with organic ligands (i. e. functional organic molecule, ionomers, ionic liquids) has demonstrated its capacity on improving catalytic activity and selectivity in electrochemical reactions such as ORR, CO_2RR, as well as oxidation processes. However, the electrocatalysts stability behavior and surface degradation dynamics of such modified systems are still not sufficiently studied.

To fully decipher the potentials of surface/interface modification in electrocatalysis, we focus our studies on the dissolution behavior of functional organics (i. e. melamine, immidazolium ionic liquids) modified model Pt (hkl) single crystal facets, in acidic medium. In regard of the excellent system sensitivity of our inductively coupled plasma mass spectrometer (detection limit down to 0.1-1 ng/L), we employed a customized scanning flow cell coupled on-line monitoring system to probe the potential-resolved surface metal dissolution dynamics. With designed electrochemical system configuration, we acquired results demonstrating the delicate stability behavior changes over transient and accumulative dissolution study on modified Pt facets. In combination of other state-of-art operando spectroscopy methods (electrochemical infrared reflection absorption spectroscopy; scanning tunneling microscopy, etc.), we further comprehended the surface oxidation process, surface blockage/modulation mechanisms on modified interfaces. Our research conferred a model stability study approach on surface modification of electrodes and electrocatalysts, providing important insights into the dynamic interfacial interaction between functional organic modifier and electrocatalysts.

Key Words: Surface organic modification, Pt single crystals, Metal dissolution, Stability study