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Dynamics of Oxide Growth on Pt Nanoparticles Electrodes in the Presence of Competing Halides by Operando Energy Dispersive X-Ray Absorption Spectroscopy

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Abstract

In this work we studied the kinetics of oxide formation and reduction on Pt nanoparticles in $HClO_4$ in the absence and in the presence of Br^- and Cl^- ions. The study combines potential step methods (i.e. chronoamperometry and choronocoulometry) with energy dispersive X-ray absorption spectroscopy (ED-XAS), which in principle allows to record a complete XAS spectrum in the timescale of milliseconds. Here, the information on the charge state and on the atomic surrounding of the considered element provided by XAS was exploited to monitor the degree of occupancy of 5*d* states of Pt in the course of oxide formation and growth, and to elucidate the competing halide adsorption/desorption phenomena. Electrochemical methods and XAS agree on the validity of a log(*t*) depending growth of Pt oxide, that is significantly delayed in the presence of Cl^- and Br^- anions. In the proximity of formation of one monolayer, the growth is further slowed down.