



University
of Victoria

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

GEER QILE

BSc (Nankai University, 2014)

“Platinum Oxide Reduction Kinetics on Polycrystalline
Platinum Electrodes”

Department of Chemistry

Thursday, September 1, 2016

9:30 A.M.

Engineering and Computer Science Building
Room 128

Supervisory Committee:

Dr. David Harrington, Department of Chemistry, University of Victoria (Supervisor)
Dr. Alexandre Brolo, Department of Chemistry, UVic (Member)

External Examiner:

Dr. Rustom Bhiladvala, Department of Mechanical Engineering, University of Victoria

Chair of Oral Examination:

Dr. Catherine Caws, French Department, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

A kinetic study on polycrystalline platinum (Pt) in sulphuric acid is presented. An electrochemical kinetic mechanism of Pt oxide reduction and surface oxide structures are proposed. The reduction reaction was studied by cyclic voltammetry (CV) and various potential programs that combine sweep and hold periods by an assembled analog instrumentation. The reduction peak was studied under three surface conditions: same oxide coverage θ and same potential E , different θ and same E , and same θ but different E , to determine the influence of θ and E on the peak potential E_p and peak shape. The double-layer charge measured previously by dynamic electrochemical impedance spectroscopy (dEIS) was used to correct the CV baseline. Differential-equation-based models as a function of θ and E were investigated to simulate the oxide reduction and oxidation, and estimate kinetic parameters. A simple mechanism combining desorption and multi-layer growth mechanisms showed good fit with both the spread-out oxidation peak and the sharp reduction peak. A microscopic surface oxide growth model was proposed to explain the surface oxides reduction mechanism.