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

of

NATALIE STUBB

BSc (University of Redlands, 2017)

“Kinetics of the Initial Stages of Platinum Oxidation”

Department of Chemistry

Tuesday, August 11, 2020
1:00 P.M.
Conducted Remotely

Supervisory Committee:
Dr. David Harrington, Department of Chemistry, University of Victoria (Supervisor)
Dr. Irina Paci, Department of Chemistry, UVic (Member)

External Examiner:
Dr. Christo Papadopoulos, Department of Electrical and Computer Engineering, UVic

Chair of Oral Examination:
Dr. Laurence Coogan, School of Earth and Ocean Sciences, UVic

Dr. Stephen Evans, Acting Dean, Faculty of Graduate Studies
Abstract

The kinetics of the oxidation of platinum metal have long been a topic of interest in the field of electrochemistry. Using a combination of cyclic voltammetry, potential step experiments, and sweep-hold experiments, this research studies the kinetics of the initial stages of oxide growth on Pt(100), Pt(111), and Pt(110) surfaces. By comparing the electrochemical results with surface X-ray diffraction (SXRD) experiments conducted at synchrotron facilities, it was found that the charge of the oxide peak is within 15 μC cm⁻² for all three surfaces. This means that on the three surfaces studied, the platinum oxide forms does not form more easily on one than any other. It was also determined that the oxide formed on Pt(111) is a Pt(II) species, consistent with an oxide like PtO. From calculations from the potential step experiments, it was determined that on Pt(100) there are two distinct regions of current decay, but that double layer charging is not one of the two seen. Instead, it was determined that is likely a two step oxidation process with the first step being an adsorption step and the second being a place exchange oxide formation step. It was also found that more charge is passed when conducting potential step experiments to the oxide region from potentials in the HUPD region than from potentials in the double layer region. Finally, the results of a sweep-hold experiment on Pt(100) show that the values for charge are similar when calculated via the data from a sweep-hold and potential step experiment from a potential in the double layer region. The results of this research help further the kinetic understanding of the platinum surface during its oxidation and reduction.