Operando Spectro-electrochemical investigations of Pt and Pt-alloys as fuel cell catalysts
Nagra, H.J.

E List of Publications

Chapter 2 is based on

Javed, H.; Kolmeijer, K.; Klein, N.; Trindell, J. A.; Schneider, G.; Mom, R. V. A Laboratory-Based Electrochemical NAP-XPS System for Operando Electrocatalysis Studies. *Vacuum* 2025, *231* (PA), 113755. https://doi.org/10.1016/j.vacuum.2024.113755.

Chapter 3 is based on

Javed, H.; Knop-Gericke, A.; Mom, R. V. Structural Model for Transient Pt Oxidation during Fuel Cell Start-up Using Electrochemical X-Ray Photoelectron Spectroscopy. *ACS Appl Mater Interfaces* 2022, *14* (31), 36238–36245. https://doi.org/10.1021/acsami.2c09249.

Chapter 4 is based on

Javed, H.; Kolmeijer, K.; Deka, N.; Sandhya, A. L. M.; Khalakhan, I.; Mom, R. V. The Potential-Dependent Structure of Pt3Ni Alloy Electrocatalysts and Its Effect on Electrocatalytic Activity. *JACS (submitted)* 2025.

F Curriculum vitae

Hassan Javed was born on 4th of June, 1992 in Lahore, Pakistan. In 2014, he obtained his Bachelor of Chemical Engineering from University of Engineering and Technology, Lahore. After graduation, Hassan worked as a Process and Operations Engineer at Engro Fertilizers, Pakistan for 2 years. In 2016, he moved to Germany for his master's degree in Chemical and Energy Engineering from TU Berlin. He completed his master in 2019 after finishing his master's thesis with Dechema Forschungsinstitut, Frankfurt, on the topic of "*Synthesis of mesoporous carbon by soft template methods for PEMFC applications*". Hassan continued his academic journey in the Netherlands, where he completed a 1-year diploma in Chemical Product Design at the Faculty of Applied Sciences, TU Delft.

In 2020, he joined the group of Dr. Rik Mom at Leiden University. His project was a part of ECCM tenure track grant, and the research primarily focused on in-situ spectro-electrochemical studies of Pt and Pt alloy fuel cell cathodes. He had the opportunity to assemble the NAP-XPS at the Leiden Institute of Chemistry as a part of his PhD project. Hassan's project was mainly focused on investigating the stability and degradation of precious metal catalysts by bringing together electrochemical and X-ray spectroscopy techniques under realistic fuel cell conditions. In the 1st year of his PhD, he participated in ECCM Graduate School in Garderen and the 2nd year, SurfCat Summer School in Copenhagen, Denmark. At both these occasions, and later at the 23rd Netherlands Catalysis and Chemistry Conference in Noordwijkerhout, he presented his research findings as a poster. The results of Hassan's research are presented in this thesis as well as showcased in several national and international conferences, such as in December 2022 at APXPS in Windisch, Switzerland, in September 2023 at International Society of Electrochemistry in Lyon, France, and in April 2024 at Ecatalytix in Strasbourg, France.

During his PhD, Hassan also supervised several bachelor and master's students towards their final projects as well as assisted in LST (Life Science and Technology) and BFW (Biofarmaceutische Wetenschappen), where a small group of bachelor students perform a joint project in a research lab. Hassan also followed several transferrable skills courses, notably the 'High impact writing course' of the HRSMC (Holland research School of Molecular Chemistry and courses like scientific conduct and effective time management offered by HRM-learning and development.

G Acknowledgements

Finishing my PhD has been one of the most challenging but rewarding experiences of my academic career. I would like to extend my heartfelt gratitude to everyone who has guided and supported me through this journey.

First and foremost, I would like to express my deepest gratitude to Prof. Marc Koper and Dr. Rik Mom for giving me the opportunity to embark on a PhD journey as one of Rik's first PhD students. Over the years, I have received in depth guidance, knowledge and endless patience from him. Being an engineer by profession, I was given the opportunity to work on a project which beautifully combined the engineering aspect with the fundamental science during my PhD. I would also like to acknowledge his truly high standards against which my work has been judged; was difficult at times, but looking back, I am thankful because they only made me a better scientist.

I am also thankful to my colleagues, past and present, that contributed their valuable effort towards the success of my work. I would like to thank Akansha Goyal, for teaching me how to build an RHE and many other basic things around the lab. I would like to thank Arthur Shih, for his insightful late-in-the-evening lab discussions when I was struggling with my experiments. Francesc, for his insightful knowledge regarding Pt and its degradation, Kees for an endless supply of graphene. I would also like to extend my gratitude to Jan Rodriguez and Nipon Deka for their support during the beamtimes.

Furthermore, my close friends whose company made it possible for me to keep my sanity during the toughest of the hours; Aleksandra, Julia, Rafael, Taissa, Nicci, Arthur, Aude and others also deserve my gratitude. A special thanks to Dr. Zeenat Hameed for her support and care, and making this journey bearable. All of you have always been there to help and bring an uplifting attitude.

Concluding, I would love to thank my parents for their unwavering support. Their sacrifices have brought me this far and I owe them every bit of the success and prosperity that I have today.