# X-ray Photoelectron Spectroscopy on Clusters: From Water Clusters to Metal & Metal-Oxide Nanoparticles

Clusters are particles consisting of several identical atoms or molecules bound together. Some clusters exist around us, like soot particles or tiny water droplets. Many other clusters can only be produced in a laboratory. There is an increasing interest in cluster research because of their growing range of applications, and because they can serve as models for macroscopic systems. In this work, the clusters contained a few thousand atoms or molecules and were studied at the MAX-IV synchrotron facility using spectroscopic techniques.

The first part of the thesis concerns water clusters. Energizing water clusters with radiation allows researchers to study problems connected to radiation therapy. In radiotherapy, it is believed that a special type of electrons that are produced when the water in biological tissue is targeted can play a role in destroying tumour cells. In the current study of water clusters, the production of these electrons is a model for the process, a model that can tell us how many of these electrons we can produce with what energy. The results of the experiments carried out in this work show a strong connection between these electrons that we call secondary electrons and their precursors and a clear trend of how their production increases with the energy we apply. These results add to our understanding of the radiotherapy method.

The second part of the thesis is dedicated to producing and studying silver and oxidized silver nanoparticles. They can be used to model a part of a chemical reaction that usually takes place in chemical factories and it is called ‘’ethylene epoxidation through catalytic production”. This reaction is important because its product the main ingredient used for making detergents. The silver-oxide particles are used to make oxygen available for the oxidation of ethylene to happen. The problem is that silver ‘oxides can be of different types, and there is little information on what and how much of each is ever there. By studying the silver-oxide particles with radiation, we can hope to identify what oxides are formed. The results we get can help researchers to distinguish and identify these silver oxides and improve this important catalytic process.

I wrote this thesis to showcase my effort, our results, and hopefully to actively contribute to these subjects. My hope is that this work will add to current literature and also inspire other people to see the usefulness and value of this research.