



Master thesis

Doping of diamond-like carbon as corrosion resistant and electrically conductive coating for metal bipolar plates in flow batteries

Starting date: as soon as possible

THE RESEARCH GROUP FOR CARBON BASED MATERIALS for electrochemical energy storage at the IAM—ESS (Institute for Applied Materials—Energy Storage Systems) studies the improvement of existing, and development of new materials for all-vanadium redox flow batteries (RFB). A major part of the available lithium sources for lithium ion batteries will be used for the electrification of vehicles within the next decades. RFBs are therefore a promising technology, especially for large scale and stationary energy storage. A major problem for commercialisation are high costs for the applied materials. One research focus is to replace expensive and hard to manufacture graphitic bipolar plates by metal plates. Bipolar plates are essential in a RFB, as they connect the cells electrically and provide the necessary pressure to operate the battery at optimal efficiency. Metals fulfil these requirements but have to withstand the harsh environment of the sulphuric acid electrolyte.

We investigate the possibility of coating titanium sheets with an electrical conductive and corrosion resistant thin layer of diamond-like carbon (DLC) in a sputter deposition process. Amorphous DLC layers are electrical insulators and need to be doped with elements with another valence such as boron, titanium, or nitrogen.

YOUR TASK is to deposit thin doped DLC films via sputter deposition and characterise the samples in regard to their electrical conductivity and corrosion resistance. We want to develop a ternary phase diagram of carbon, titanium, and nitrogen to evaluate the possibilities and limits of DLC coatings. Further investigations include scanning electron microscopy to study the morphology and Raman spectroscopy to predict physical properties of the film based on the carbon bonding state.

Ideally, you have a background in material science, chemistry, chemical engineering or similar. More important, you are interested in the topic of energy storage and thin films.

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