Climate change and the limited availability of fossil fuels do not just increase the demand for renewable energy sources, but also for new battery technologies.

- A higher amount of battery-powered cars can reduce the amount of emitted greenhouse gases significantly.
- Photovoltaic and wind power are excellent alternatives to conventional energy sources. However, those suffer from unsteady delivery. Thus, battery systems are needed as a buffer.

Metal-air batteries are a promising system for both applications. Compared to other battery technologies, they provide a very high theoretical energy density, which is just limited by the size of the anode as oxygen is provided as a reactant from the ambient atmosphere.

Primary metal-air with zinc anodes batteries are commercially available for decades. In this case, both electrodes just have to support reactions, which are considered with discharging of the battery. In secondary systems, however, reactions at the cell electrodes need to be reversible. This leads to several problems especially concerning the air-electrode. Oxygen is reduced during discharging of the battery and evolved during charging. Those air-electrodes usually consists of three constituents: A catalyst (or several catalysts), a conductive support material, and a hydrophobic binder. In primary systems, the conductive support is mainly carbon-based. Carbon materials offer a high conductivity and a high specific surface area. Surface areas are crucial in electrochemical systems. However, carbon is not stable at potentials where the oxygen evolution reaction takes place. A corrosion-stable alternative to carbon is nickel. We work on electrodes based on porous nickel supports, made by galvanic deposition. Past works show that these structures offer high specific BET surface areas compared to conventional nickel based air-electrodes. Our work focuses on research on the oxygen evolution at these structures and on the implementation of those in bifunctional air-electrodes. SEM images of the investigated structures are shown in figures 1 to 3.
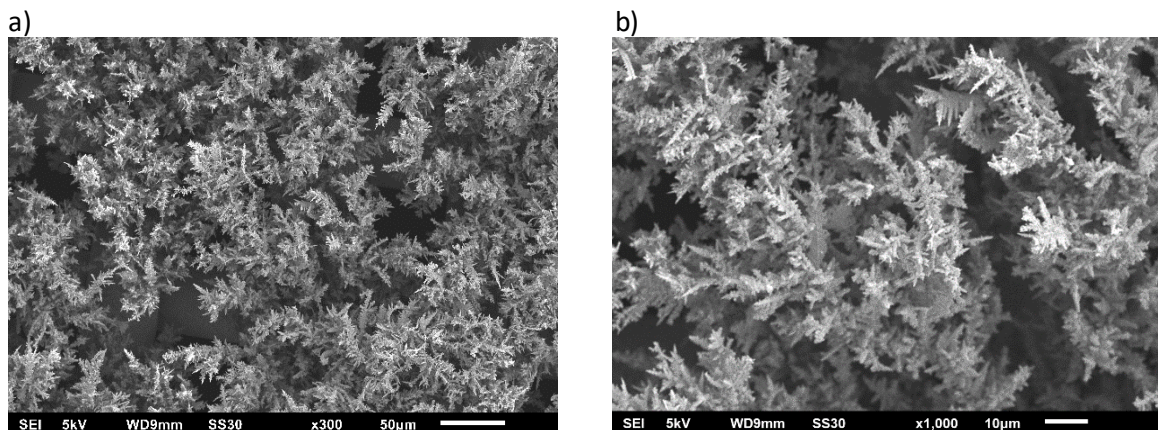

Figure 1: SEM image of galvanically deposited Ni-structures from electrolyte composition 1 in 300x magnification (a) and 1000x magnification (b).
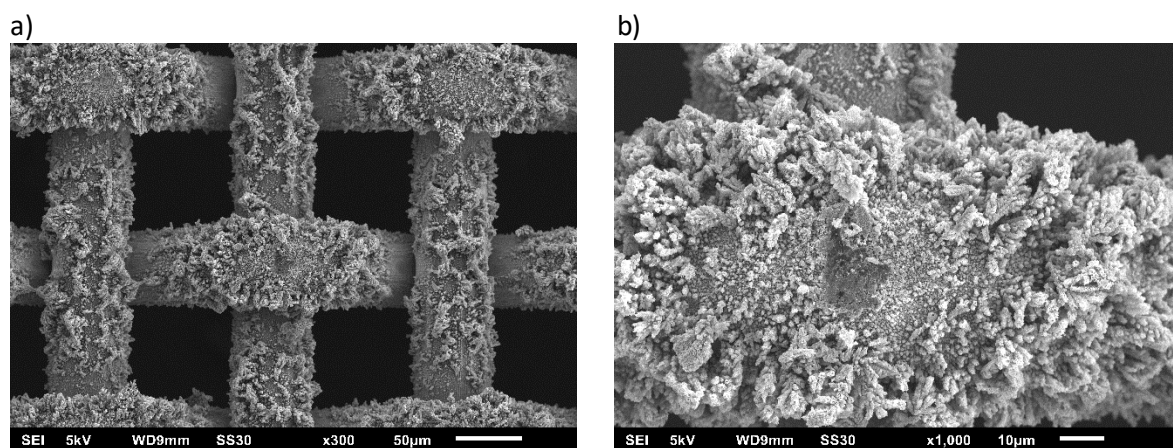
Figure 2: SEM image of galvanically deposited Ni-structures from electrolyte composition 2 in 300x magnification (a) and 1000x magnification (b).
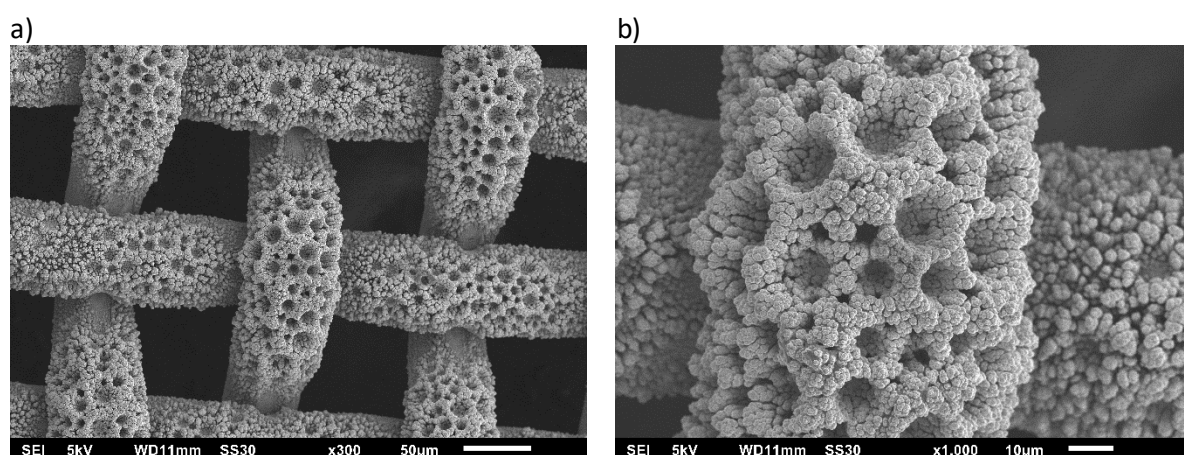

Figure 3: SEM image of galvanically deposited Ni-structures from electrolyte composition 3 in 300x magnification (a) and 1000x magnification (b).