Master/Bachelor Thesis Project or HiWi Position

UNIVERSITÄT BAYREUTH

Lehrstuhl für Werkstoffverfahrenstechnik

Carbon Dioxide Reduction at Cu Foams Fabricated via the Dynamic Hydrogen Bubble Templating Route as a Promising Power-to-X Approach

Carbon Dioxide Reduction (CO_2R) provides a promising Power-to-X approach for employing renewable electricity to convert CO_2 into C_{2+} energy carriers with high power density, e.g. ethane, ethylene, ethanol…etc. In simpler terms, CO_2R enables both counteracting the sharply increasing CO_2 emissions in the atmosphere and storing renewable energy. For this purpose, Cu foams synthesized via the Dynamic Hydrogen Bubble Templating (DHBT) route have attracted much research interest as CO_2R electrodes for two main reasons. First, the galvanostatically generated H_2 bubbles during the DHBT serve as negative templates, around which Cu is electrodeposited in a foam-like structure of a large accessible surface area and with highly active surface nano dendrites within the pore walls. Second, the C-C coupling of CO_2R intermediates preference on the Cu material is agreed to be the key for C_{2+} products formation.

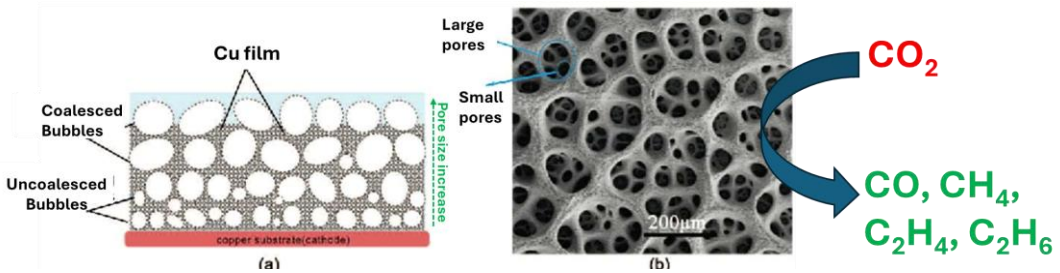

Fig.1: Schematic representation of the DHBT method for synthesizing Cu foams (a), and an SEM image of a Cu-foam sample produced via the DHBT approach (b).

In this research project, Cu foam electrodes are to be synthesized via the DHBT method at different operational conditions, including the galvanostatic charge, stirring the DHBT bath, elevating or lowering the DHBT bath temperature, incorporating additives…etc. Subsequently, the electrocatalytic CO_2R performance of these electrodes is to be investigated in association with chromatographic analysis of CO_2R liquid and gaseous products. Additional characterization of the Cu foams via scanning electron microscopy (SEM), X-ray diffraction analysis (XRD), and contact angle measurement is also among the scope of this work. The research topic is aimed at chemistry, chemical engineering, or material science students with an affinity for electrocatalysis. If you are interested, just contact me and we will talk about the project in more detail over a cup of coffee.

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