CO_2 Reduction on Gas Diffusion Electrodes

Dr. Sebastian Sanden and Prof. Dr. Ulf-Peter Apfel

Tel.: 0234 32 - 27702 and 21831

E-Mail: Sebastian.sanden@rub.de and ulf.apfel@rub.de

CO_2 electrolysis allows for both chemical storage of energy from intermittent renewable sources and the production of value-added basic chemicals. But to achieve i.e. CO yields from CO_2 reduction that are feasible for industrial applications, classical H-type, three electrode systems cannot be used. H-type electrolyzers cannot achieve the necessary CO turnover due to mass transport limitations of CO_2 in aqueous electrolytes. Therefore, a phase boundary layer between gaseous CO_2 and a proton source must be established to alleviate these limitations. Gas diffusion electrodes can create 3-phase boundaries which maximize the availability/activity of CO_2, H^+ and the electrocatalytic surface (c.f. Figure 1).

Using gas diffusion electrodes and silver-based catalysts we are aiming to achieve high current densities during CO_2 reduction in this "hands-on" practical work. The laboratory work will be centered around the fabrication of gas diffusion electrodes (GDE), the implementation in an electrolyzer system and the analysis of electrochemical data in combination with gas-phase analysis of the reactant mixtures.

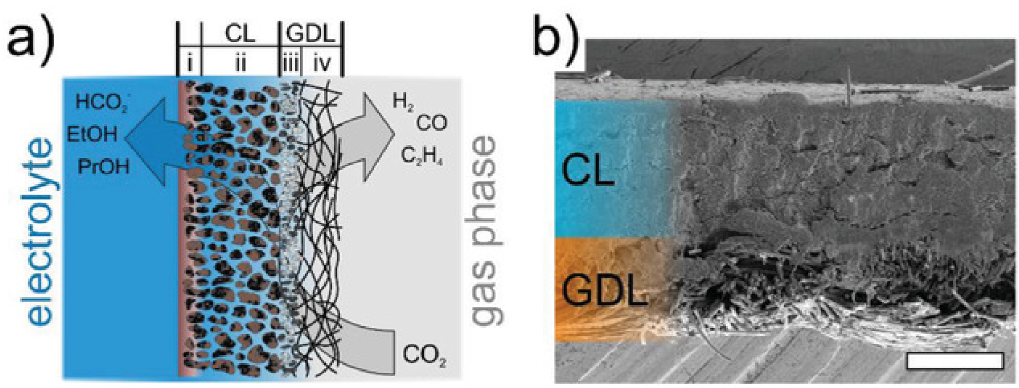

Figure 1. Schematic illustration of a gas diffusion electrode. The electrodes consist of i) an ionomer coating, ii) a PTFE bound catalyst layer, iii) a microporous layer, and iv) a gas diffusion layer. b) Cross-sectional SEM micrograph of a representative GDE. The scale bar is 250 µm. Figure adapted from Junge Puring, et al., (2021). Advanced Sustainable Systems, 5(1).