Reversible electrochemical capture and release of CO2 using anthraquinone

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Abstract

The general strategy of Carbon Capture and Utilization (CCU) is the usage of carbon dioxide (CO_2) as feedstock material for sustainable and fossil-fuel free chemicals. An important requirement prior catalysing the conversion of CO_2 is a controlled capturing and release process of CO_2 [1]. As the industrial absorption processes require either high heat or vacuum input, developing more benign alternatives is still a challenging subject[2].

Recent examples of technologies for electrochemical capture of CO_2 are using organic molecules like sulfides[3], bipyridines[4,5] or carbonyl compounds[6], mostly homogeneously dissolved in organic solutions. In order to circumvent the use of large quantities of organic solvents, our group recently reported electrochemical adsorption and desorption of CO_2 in an ambient condition by aromatic carbonyl pigments, like quinacridone[7] or a naphthalene bisimide derivatative[8].

As a continuing series of the previous works, herein we demonstrate that anthraquinone thin-film electrodes can electrochemically capture and release CO_2 with an uptake capacity of 5.9 mmol g^{-1}, which is comparable with that of an industrial amine process (8 mmol g^{-1})[8,9]. In contrast to the previous studies, anthraquinone is industrially used and therefore cheap and moreover we could demonstrate this process to fully operate in aqueous solution. Furthermore, the proposed chemical formation of anthraquinone carbonate-like structure was supported by in-depth studies using in-situ spectroelectrochemistry with UV-vis and ATR-FTIR techniques[10].

Keywords: *organic pigments, electrochemistry, carbon dioxide capture, spectroelectrochemistry*

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Biography

Dominik Wielend graduated from the bachelor as well as the master studies in technical chemistry from the

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The current research topic for the PhD studies involve the investigation of organic electro-catalysts for oxygen reduction.