Inorganic Materials & catalysis
Electrocatalysis
Research Project – Emiel Hensen/ Marta Figueiredo/ Dimitra Anastasiadou

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Electrocatalytic synthesis of high value compounds derived from CO_2 and NO_x

Background

The constantly increasing world population, life expectancy and our current, rich in energy, everyday needs result in a massive accumulation of fossil fuels, extensive use of fertilizers and industrial waste production. In order to move towards a more sustainable and circular economy it is important to develop alternative fuels and chemicals for multiple areas of applications such as the chemical and agriculture industry. The use of electrochemistry for the synthesis of fuels and commodity chemicals is seen as a very promising tool towards the independency of the industry from fossil fuel based technologies. [1] The electrochemical routes are industrially attractive as they are easily scalable and allow a large scale production, while using electricity from renewable resources as their energy source.

This project aims at the electrochemical synthesis of high value compounds such as urea and/or carbamates by utilizing the carbon dioxide (CO_2) and nitrogen oxides (NOx) as starting materials. [2] Both starting compounds are considered waste and serious efforts have been made in the last decades to convert them into more benign and useful materials. [3], [4] Therefore, we suggest to combine the conversion of waste products into important precursors for the chemical industry.

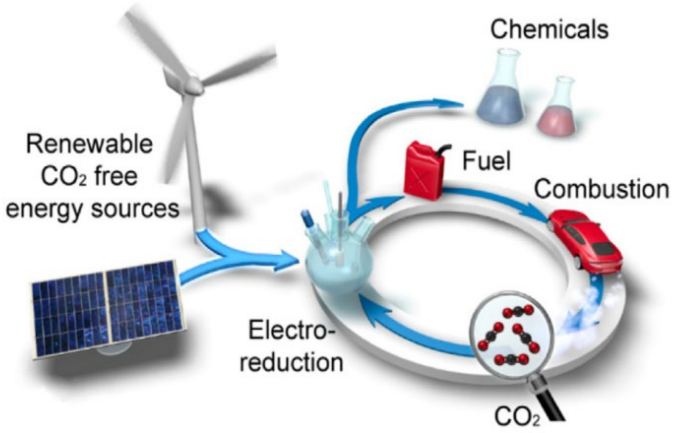

Figure 1: Carbon recycling powered by renewable electricity sources [5]

Research goals:

- Development and characterization (e.g. SEM, XRD, XPS) of novel catalysts for the simultaneous electroreduction of CO_2 and NOx towards compounds with C-N bonds
- Reaction mechanism study with common electrochemical techniques (e.g. Cyclic Voltammetry, Linear Sweep Voltammetry) and complementary analytical techniques (e.g. GC-MS, HPLC, NMR)
- Optimization of the reaction conditions for a flow cell configuration

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References:

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