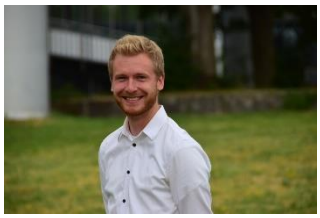
Yannick Jännsch erhält Preis für das beste Poster

Arbeit zur elektrochemischen CO_2-Direktumsetzung zu Ethylen ausgezeichnet

Auf der *International Conference on Electrocatalysis for Renewable Energy*, die im März 2021 als Online-Tagung stattfand, hat **Yannick Jännsch**, Projektingenieur und Doktorand am Lehrstuhl für Funktionsmaterialien, ein Poster präsentiert. Es behandelte die Synthese und Anwendung eines CuO-Katalysators um CO_2 zu Ethen unter anwendungsnahen Bedingungen zu reduzieren. Das Poster hat die Verantwortlichen so überzeugt, dass Herr Jännsch mit dem ersten Poster-Preis ausgezeichnet wurde.



Die Arbeit wurde von der Bayerischen Forschungsstiftung (BFS) gefördert. Projektpartner für dieses zukunftsweisende Thema ist die Firma Siemens Energy.

Zitatnachweis:

Y. Jännsch, M. Hämmerle, R. Moos:
Electrochemical CO_2 Reduction to Ethylene via a CuO Nanocatalyst with Focus on Long-term Stability and Scalability
International Conference on Electrocatalysis for Renewable Energy, 29.03 - 31.03.2021, Online-Tagung

Eine Kurzusammenfassung ist im ERef der Universität Bayreuth (hier) erhältlich

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POSTER AWARD CERTIFICATE

International Conference on
"ELECTROCATALYSIS FOR RENEWABLE ENERGY"

We hereby confirm that

Yannick Jännsch

Won the Poster Award of the **International Conference on "ELECTROCATALYSIS FOR RENEWABLE ENERGY"** organized within the ITN ELCOREL by the Leiden University on-line, 29–31 March 2021.

In Prague and Leiden 31 March 2021

Klaudie Soukupová
Consortium Manager
Elcorel

Petr Krtil
Chairman of the Supervisory Board
Elcorel

Marc Koper
Member of the Supervisory Board
Elcorel

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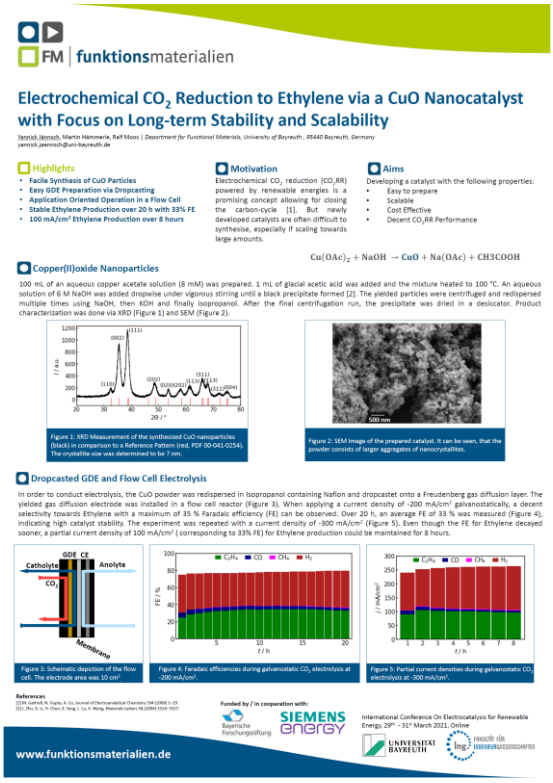

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Electrochemical CO_2 Reduction to Ethylene via a CuO Nanocatalyst with Focus on Long-term Stability and Scalability

Yannick Jännsch, Martin Hämmerle, Ralf Moos | *Department for Functional Materials, University of Bayreuth , 95440 Bayreuth, Germany*
yannick.jaennsch@uni-bayreuth.de

Highlights
- Facile Synthesis of CuO Particles
- Easy GDE Preparation via Dropcasting
- Application Oriented Operation in a Flow Cell
- Stable Ethylene Production over 20 h with 33% FE
- 100 mA/cm² Ethylene Production over 8 hours

Motivation
Electrochemical CO_2 reduction (CO_2RR) powered by renewable energies is a promising concept allowing for closing the carbon-cycle [1]. But newly developed catalysts are often difficult to synthesise, especially if scaling towards large amounts.

Aims
Developing a catalyst with the following properties:
- Easy to prepare
- Scalable
- Cost Effective
- Decent CO_2RR Performance

$$Cu(OAc)_2 + NaOH \rightarrow CuO + Na(OAc) + CH3COOH$$

Copper(II)oxide Nanoparticles

100 mL of an aqueous copper acetate solution (8 mM) was prepared. 1 mL of glacial acetic acid was added and the mixture heated to 100 °C. An aqueous solution of 6 M NaOH was added dropwise under vigorous stirring until a black precipitate formed [2]. The yielded particles were centrifuged and redispersed multiple times using NaOH, then KOH and finally isopropanol. After the final centrifugation run, the precipitate was dried in a desiccator. Product characterization was done via XRD (Figure 1) and SEM (Figure 2).

Figure 1: XRD Measurement of the synthesized CuO nanoparticles (black) in comparison to a Reference Pattern (red, PDF 00-041-0254). The crystallite size was determined to be 7 nm.

Figure 2: SEM Image of the prepared catalyst. It can be seen, that the powder consists of larger aggregates of nanocrystallites.

Dropcasted GDE and Flow Cell Electrolysis

In order to conduct electrolysis, the CuO powder was redispersed in isopropanol containing Nafion and dropcasted onto a Freudenberg gas diffusion layer. The yielded gas diffusion electrode was installed in a flow cell reactor (Figure 3). When applying a current density of -200 mA/cm² galvanostatically, a decent selectivity towards Ethylene with a maximum of 35 % Faradaic efficiency (FE) can be observed. Over 20 h, an average FE of 33 % was measured (Figure 4), indicating high catalyst stability. The experiment was repeated with a current density of -300 mA/cm² (Figure 5). Even though the FE for Ethylene decayed sooner, a partial current density of 100 mA/cm² (corresponding to 33% FE) for Ethylene production could be maintained for 8 hours.

Figure 3: Schematic depiction of the flow cell. The electrode area was 10 cm²

Figure 4: Faradaic efficiencies during galvanostatic CO_2 electrolysis at -200 mA/cm².

Figure 5: Partial current densities during galvanostatic CO_2 electrolysis at -300 mA/cm².

References

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Lehrstuhl für Funktionsmaterialien | Universität Bayreuth | Telefon: +49 (0)921 55 7401 | E-Mail: funktionsmaterialien@uni-bayreuth.de