

## SEMINAR SERIES

# HIGHLIGHTS IN ENERGY RESEARCH

30.11. 2017, 10:30 - 11:30, ENERGYPOLIS Sion, 4<sup>th</sup> floor, Zeuzier room

## New catalyst concepts for the electrochemical conversion of CO<sub>2</sub>

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The electrochemical conversion of CO<sub>2</sub> into products of higher value can be considered as a seminal approach that has the technological potential of contributing to a closing of the anthropogenic carbon cycle. Such CO<sub>2</sub> electroreduction (CO<sub>2</sub>RR) offers not only the unique chance to reduce the amount of environmentally harmful CO<sub>2</sub>, it provides in addition means of storing intermittently produced excesses of electricity originating from renewables like wind, solar and hydro sources. Major challenges that currently prevent such electrochemical CO<sub>2</sub> conversion technology from being implemented into industrial applications are related to the enormous overpotentials needed for CO<sub>2</sub> activation, thus typically resulting into a poor energy efficiency of the entire full cell-level process. Among the vast number of materials screened so far, it is Cu which deserves particular attention since it is the only catalyst which is capable to convert CO<sub>2</sub> into hydrocarbons and alcohols. Crucial for the performance of the Cu catalysts is their pre-treatment, e.g. by thermal annealing, exposure to oxygen plasma, electrodeposition, and electroreduction. An additive-assisted metal foam electrodeposition can be considered as a promising approach towards design and production of novel high-surface area CO<sub>2</sub>RR catalysts.<sup>[1-2]</sup> For selected examples, it will be demonstrated that oxide-derived Cu foam catalysts can reach Faradaic efficiencies of up to 25% for the production of highly valuable C<sub>2</sub> and C<sub>3</sub> alcohols. Identical location (IL) SEM/TEM investigations in combination with *operando* Raman and EXAFS/XANES measurements clearly prove that the actually active catalyst forms only under reactive conditions during an ongoing CO<sub>2</sub>RR.

### References:

- [1] A. Dutta, M. Rahaman, N. C. Luedi, M. Mohos, P. Broekmann, ACS Catal. 6 (2016) 3804-3814
- [2] A. Dutta, M. Rahaman, M. Mohos, A. Zanetti, P. Broekmann, ACS Catal. 7 (2017) 5431-5437



### CV: PD Dr. Peter Broekmann

Peter Broekmann received his PhD degree in Physical Chemistry in 2000 from the University of Bonn (Germany). After his PhD he stayed in 2000/2001 as postdoctoral researcher (Feodor-Lynen fellowship of the Alexander-von-Humboldt foundation) in the Surface Physics group at the University of Twente (The Netherlands). From 2002 to 2006 Peter Broekmann worked as project leader in the Collaborative Research Center (SFB 624) *Chemical Templates* at the University of Bonn. He then accepted a position at BSAF SE (Global Business Unit Electronic Materials, Ludwigshafen, Germany) where he was in charge of the development of electroplating processes for advanced Damascene (sub-32 nm technology node) and TSV (Through Silicon Via) applications. Since 2008 Peter Broekmann is leading the Surface Electrochemistry group at the Department of Chemistry and Biochemistry in Bern. His research focuses on the development of additive-assisted metal plating processes for industrial applications and the electrochemical conversion of CO<sub>2</sub> into products of higher value.