



PhD Program between the Freie Universität Berlin (FUB) and the China Scholarship Council (CSC)

Open PhD Position at Freie Universität Berlin, offered only to Chinese CSC scholarship candidates 2019

Please Note: this PhD position is only offered to Chinese PhD candidates for the application in the framework of the FUB-CSC PhD Program.

<u>Department/Institute:</u>	Institute of Chemistry and Biochemistry
<u>Subject Area:</u>	Physical Chemistry – CO ₂ photoelectrochemistry
<u>Name of Supervisor:</u>	Dr. Matthew T. Mayer
<u>Number of Open PhD Positions:</u>	1
<u>Type of the PhD Study:</u>	Full-time
<u>Project Title:</u>	Gas diffusion photoelectrodes for carbon dioxide reduction

PhD Project description:

Carbon dioxide can be electrochemically converted into valuable chemicals and fuels, and when powered by renewable energy resources, this process tackles both CO₂ emissions mitigation as well as renewable energy storage. In this project we will develop advanced multi-phase photoelectrochemical systems capable of synthesizing hydrocarbons and alcohols from inputs of only CO₂, sunlight, and water.

The major challenges in electrochemical CO₂ conversion are poor product selectivity, low efficiency, and slow rates of conversion when performed in aqueous reactors. In this project we will address these challenges by designing novel gas diffusion reactors with gaseous CO₂ fed directly to the photoelectrode surface. The influence of semiconductor structure (morphology, electronic), light concentration, pressure, pulsed illumination, gas composition, etc., on catalytic efficiency and selectivity will be investigated. The aims are to gain mechanistic understanding into electrocatalytic processes on photoelectrode surfaces in potentially industrially-relevant device architectures.

* Student will be enrolled in the FUB Chemistry doctoral program. Research will be performed in the affiliated group of Dr. Mayer at the Helmholtz Center Berlin, a research institute for materials and energy.

Language requirements:

Highly skilled in English speaking and writing (IELTS: 6,5 oder TOEFL: 95 ibt)

Academic requirements:

Master's degree in chemistry, materials science, or related field.

Research experience in one or more of the following is preferred: semiconductors, electrochemistry, photoelectrochemistry, analytical chemistry, photovoltaics, fuel cells

Information of the professor or research group leader:

Dr. Matthew T. Mayer
Helmholtz Young Investigators Group – *Electrochemical Conversion of CO₂*
Helmholtz-Zentrum Berlin (HZB) für Materialien und Energie, GmbH
14109 Berlin, Germany

Website: https://www.helmholtz-berlin.de/forschung/oe/ee/necc/index_en.html

Publications: <https://scholar.google.com/citations?user=Y5CgyWcAAAAJ&hl=en>

Background:

B.S. Chemistry: Boise State University, USA

Ph.D. Chemistry: Boston College, USA

Postdoc: Ecole polytechnique fédérale de Lausanne (EPFL), Switzerland

In 2017, Dr. Mayer was awarded a Helmholtz Young Investigators Group (Nachwuchsgruppe) fellowship worth 1.5M EUR over five years to initiate an independent research group on CO₂ conversion at the HZB. He is co-author on more than 35 research articles in the fields of photoelectrochemistry, electrocatalysis, photovoltaics, and nanomaterials.

Relevant publications:

Pan, L. *et al.* Boosting the performance of Cu₂O photocathodes for unassisted solar water splitting devices. *Nature Catalysis* **1**, 412–420 (2018).

Schreier, M. *et al.* Solar conversion of CO₂ to CO using Earth-abundant electrocatalysts prepared by atomic layer modification of CuO. *Nature Energy* **2**, 17087 (2017).

Schreier, M. *et al.* Covalent Immobilization of a Molecular Catalyst on Cu₂O Photocathodes for CO₂ Reduction. *J. Am. Chem. Soc.* **138**, 1938–1946 (2016).

Schreier, M. *et al.* Efficient and selective carbon dioxide reduction on low cost protected Cu₂O photocathodes using a molecular catalyst. *Energy Environ. Sci.* **8**, 855–861 (2015).

Schreier, M. *et al.* Efficient photosynthesis of carbon monoxide from CO₂ using perovskite photovoltaics. *Nature Commun.* **6**, 7326 (2015).

Please Note: In a first step, the complete application should be submitted to the Beijing Office for evaluation by January 4th, 2019. Please do not contact the professor before. He/she will get in contact with you after having received the complete application via the Beijing Office in January.