

**Type of position:** PhD  
**Name of Institute:** Institute for Technical Chemistry and Environmental Chemistry  
**PI:** Prof. Dr. Martin Oschatz  
✉: [martin.oschatz@uni-jena.de](mailto:martin.oschatz@uni-jena.de)  
🌐: <http://www.ag-oschatz.uni-jena.de>

**Title:** **Electrocatalysis in Confined Ionic Liquid Media for Electrochemical Ammonia Synthesis“ (m/w/d)**  
→ PhD Thesis within the framework of the European Research Council Project “CILCat”

**Start date:** **01.10.2022**

**Short description:**

Nitrogen is a very unreactive molecule which is mainly due to the high dissociation enthalpy of the triple bond in dinitrogen. Therefore, the scalable catalytic conversion of N<sub>2</sub> was one of the milestones chemical industry has achieved in the 20th century. Ammonia - the industrial product of this “artificial N<sub>2</sub> fixation” is the result of the Haber-Bosch (H-B) process. The fundamental principles of industrial nitrogen fixation have barely been touched for more than 100 years. Moreover, the latter is an energy intensive process and is associated with high CO<sub>2</sub> emissions. In view of the increasing CO<sub>2</sub> concentration in the atmosphere, ongoing energy transition, and the development of novel energy concepts for the conversion of small molecules, alternative methods for artificial N<sub>2</sub> fixation are in demand. Especially, the electrocatalytic nitrogen reduction reaction (NRR) is a possible approach for future sustainable and delocalized ammonia production from nitrogen and water at ambient temperature and pressure. This PhD position will deal with the synthesis of novel electrocatalysts based on ionic liquids embedded in porous carbon materials. The latter will be intensively studied as catalysts in the NRR in order to illuminate the underlying electrochemical mechanisms.

**Your work will consist of two main parts:**

- 1) Syntheses of novel electrocatalysts based on porous carbon materials including **advanced materials synthesis** as well as material characterization (**gas physisorption methods**, X-ray photoelectron spectroscopy (**XPS**), Raman spectroscopy, electron microscopy (SEM/TEM), small-angle X-ray scattering (SAXS))
- 2) Application of synthesized catalysts in the **Nitrogen reduction reaction (NRR)** including **investigation and improvement of different cell setups** and in-depth **analysis of electrochemical mechanisms** using advanced analytical methods including spectroscopy and NMR experiments.

**Required skills:**

- A master’s degree in chemistry, materials science, or nanoscience
- Solid knowledge of materials synthesis and characterization
- Basic knowledge of electrochemical characterization methods
- Practical skills and fun in establishing new experiments or getting familiar with new techniques and devices
- social skills and the willingness to integrate into an open-minded group
- excellent written and oral communications skills in English

Résumé and references can be directed to [martin.oschatz@uni-jena.de](mailto:martin.oschatz@uni-jena.de) or [konstantin.schutjajew@uni-jena.de](mailto:konstantin.schutjajew@uni-jena.de).