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Unifying Concepts in Catalysis

UniCat Colloquium

DR. ULRIKE KRAMM

Brandenburgische Technische Universität Cottbus-Senftenberg

Mössbauer spectroscopy - a powerful tool for the characterization of active sites in Fe-N-C catalysts for the oxygen reduction reaction

The proton exchange membrane fuel cell (PEM-FC) is a promising device for the energy supply in cars. Today, platinumbased catalysts are the state of the art materials in PEM-FC. However, the high costs of platinum hinder a breakthrough of the FC technology.

As most of the platinum is required for the sluggish oxygen reduction reaction (ORR) the replacement of platinum by a cheap non-precious metal catalyst (NPMC) should enable enormous cost reduction. Especially during the last decade, Fe-N-C catalysts have proven to be a realistic alternative for the ORR. Today, they reach power densities of about 65 % of platinum catalysts (0.3 mgPt cm-2).

Motivated by these promising results the number of groups working on these NPMC has drastically increased. They all work on different preparation strategies for the optimization with respect to catalytic activity and stability in wet-chemical and/or fuel cell conditions. A common observation is the heterogeneous composition of all these catalysts independent from the preparation strategy or achieved ORR activity. All approaches; however, are restricted by limited long-term stability of the obtained catalysts.

In this respect, 57Fe Mößbauer spectroscopy has proven a powerful technique for the haracterization of Fe-N-C catalysts. Important information on the electronic properties of biomimetic active FeN4 sites in Fe-N-C catalysts but as well insides into the formation processes occurring during the catalyst preparation can be obtained.

In this talk I will compare different preparation strategies with respect to their structural composition and catalytic performance. It will be shown that even the preparations of today's most promising catalysts still have space for further improvement regarding the dens ity of active sites. It will also be addressed how Mößbauer spectroscopy can be utilized in the identification of possible degradation mechanisms.

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TU Berlin, Institute of Chemistry
Straße des 17. Juni 115, 10623 Berlin

Building C, Lecture Hall **C 264**

Prof. Strasser (TUB)
Organizer

Coffee and cake will be served 30 minutes before the lecture. Guests are cordially invited to attend!