# Masters Student Project: The effect of beam damage within the scanning transmission electron microscope on catalyst nanoparticles under a gas environment.

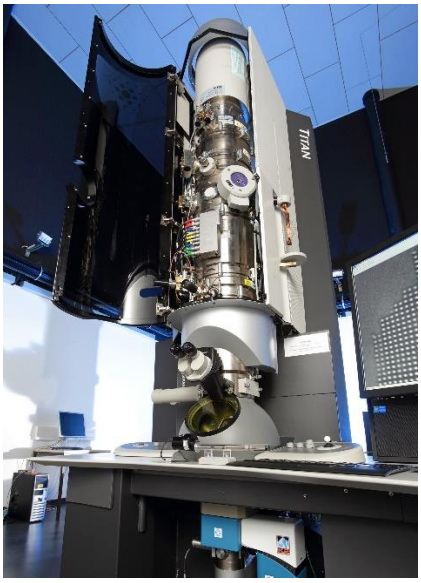
**Start of work**: spring 2018/by arrangement

**Job Description:** One of the main challenges in microstructural investigations of catalysts is in bridging the so-called 'pressure-gap'. This occurs because microstructural investigations are carried out under vacuum, whereas the final operating pressures for real catalytic reactions are considerably higher. This pressure difference or 'pressure-gap' may well lead to differences in the catalyst microstructures between the lab investigation and reality. In-situ electron microscopy is a fascinating area of research within the field of heterogeneous catalysis, as it allows us to study catalysts under realistic gaseous conditions and temperatures providing valuable insights into their structural degradation. The Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons (ER-C) is one of the world-wide leading institutes for electron microscopy, currently operating eleven transmission electron microscopes. For in-situ electron microscopy, a specialized holder based on microelectromechanical systems (MEMS) technology is used to create a very small reaction chamber. The impact of high energy electrons on both the MEMS chip windows and the particles themselves, however, can cause substantial damage depending on the electron dose used.

In this project we propose a systematic study on the effect of electron dose on the MEMS chip holder as well as on the catalyst nanoparticles, with the aim of determining the optimum dose level in the trade-off between damage and signal. Characterizing the effect of the electron beam will result in a greater understanding of in-situ experiments in the electron microscope in order to bridge the 'pressure-gap'. Towards the end of the project the optimised dose will be used to look at Pt/carbon catalysts for hydrogen fuel-cell applications.

The candidate should have a Bachelor's degree in Materials Science, Physics or Chemistry or equivalent and good English language skills. Basic data analysis and programming skills would also prove helpful.

**Please contact: Dr. Katherine E. MacArthur, k.macarthur@fz-juelich.de by 15.03.2018**




PGI 5 Microstructure Research, The Ernst Ruska Centre for Microscopy and Spectroscopy with Electrons,
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*Figure 1 – (left) an aberration corrected FEI Titan to be used for these investigations and (right) the new Audi h-tron model which runs on hydrogen fuel-cell technology.*