

The STM team at the Chair of Physical Chemistry of the Technical University of Munich focuses on fundamental dynamics in catalytic processes on small supported metal clusters and in functional surfaces. For our collaborative project *Connect – Catch – Couple* we offer a

PhD Position (66% TV-L E13) for STM Studies on Cluster-Molecule Interactions at the Solid-Liquid-Interface

Project Description

Size-dependent structural and electronic effects make clusters and nanoparticles extremely interesting for highly selective, mild catalytic processes. The intrinsic metastability of nanoparticulate matter, however, calls for a precise control of particle dissolution and ripening while tuning the catalytic activity. At the solid/liquid interface, we explore these phenomena from a fundamental point of view by scanning tunneling microscopy (STM), at the atomic scale under a unique combination of size and potential (electrochemical) control.

This project seeks a fundamental understanding of the chemical interaction between organic molecules and metallic Pd nanostructures during C–C coupling. STM in vacuum and in solution will provide detailed insight into the metal-molecule interaction at the atomic scale, by studying individual molecules in combination with a systematic variation of structure and size of the metal, supported on carbon and carbonitride films. We want to answer various key questions: How do molecules interact with Pd surfaces of different morphology? How are the reactants activated? How is the catalyst stability affected by single reaction steps? How can the Pd particle size and oxidation state, the support and solvent systematically be tuned to increase the catalyst activity and stability?

As a successful candidate, you will investigate the Pd nanostructures under realistic mild coupling conditions via electrochemical STM. Within our European NEP network, you will install an additional fast electronics module to address local particle dynamics on the time scale of seconds. You will collaborate strongly with our partner at the University of Graz who performs complementary low temperature STM experiments to study the metal-molecule bond with high spatial resolution, focusing onto favorable molecule-metal arrangements and transformations.

Required qualifications

Prospective candidates have a degree in chemistry, physics or a related field and bring a basic experimental knowledge in processing solid/liquid interfaces. They are keen to perform sophisticated physico-chemical experiments, to solve technical challenges and bring along good communication skills in English. The successful candidate will further show a willingness to learn about new techniques and scientific fields and contribute their own ideas to the project. We are looking for a team player who collaborates closely with other team members while also working independently on their own project. Experience in surface electrochemistry, scanning probe microscopy, and/or basic programming skills (MatLab, Python, ...) is advantageous.

Our offer

The position is funded as part of a DACH grant, available immediately and will be limited to three years. Payment will be based on the Collective Agreement for the Civil Service of the Länder (*TV-L*). TUM strives to raise the proportion of women in its workforce and explicitly encourages applications from qualified women. Applications from disabled persons with essentially the same qualifications will be given preference.

Application

Please send your CV, letter of motivation (max. 1 page) and contact details of two potential references to Friedrich Esch (friedrich.esch@tum.de) by 30.04.2022. Further information on our research group is available at <https://www.department.ch.tum.de/pc/research/solid-liquid-interface-ecstm/>.