

Press Release

Garching, March 11, 2010

Miracles of the nanoworld:

Noise makes nanoelectrodes faster

Nanotechnology has rapidly gained in importance during recent years. However, when developing nanosystems even further scientists come up against the same problem time and again: many of the principles familiar from the normal, macroscopic world are not valid in the nanoworld. Physicists from the Technische Universitaet Muenchen (TUM) have now developed a method with which they can compute the behavior of electrochemical nanosystems. Their work is presented in the online version of the Proceedings of the National Academy of Sciences (PNAS).

In the world with which we are familiar chemical reactions appear to proceed in a continuous way. If one considers electrodes, which are only a few nanometers in size, however, chance suddenly comes into play: depending on the random motion of the molecules in the environment, reactions take place at one electrode, and at the other one first a short time later. The exact point in time at which a reaction will take place cannot be predicted. The continuous flow of current begins to stutter.

Models which accurately describe the macroscopic situation are no longer applicable on the nanoscale, and new descriptions must be found. Professor Katharina Krischer and Dr. Vladimir Garcia-Morales from the Physics Department of the TUM have now developed a calculation model that enables these reactions to be simulated.

In the course of their investigations, the scientists discovered a surprising effect: electrochemical reactions proceed faster on isolated nanoelectrodes than on macroscopic electrodes. With the aid of their new calculation models they were able to clarify how this effect comes about. The randomness of the occurrence of an electrochemical reaction causes molecular noise. In contrast to our daily experience where noise is more likely to be an interfering factor, it plays a constructive role at the nanoelectrodes.

The work published was supported by the European Union (project DYNAMO) and the Nanosystems Initiative Munich cluster of excellence. Starting April, Dr. Garcia-Morales will be working as a Junior Fellow at the Institute for Advanced Study of the Technische Universitaet Muenchen (TUM-IAS).

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Original Publication:

Fluctuation enhanced electrochemical reaction rates at the nanoscale,
Vladimir García-Morales and Katharina Krischer,
PNAS early online edition, doi:10.1073/pnas.0909240107
Link: <http://www.pnas.org/content/107/10/4528.abstract?sid=6d16fb98-2e01-474d-a9d4-499bb32cff02>

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Technische Universität München (TUM) is one of Germany's leading universities. It has roughly 420 professors, 7,500 academic and non-academic staff (including those at the university hospital "Rechts der Isar"), and 24,000 students. It focuses on the engineering sciences, natural sciences, life sciences, medicine, and economic sciences. After winning numerous awards, it was selected as an "Elite University" in 2006 by the Science Council (Wissenschaftsrat) and the German Research Foundation (DFG). The university's global network includes an outpost in Singapore. TUM is dedicated to the ideal of a top-level research based entrepreneurial university. <http://www.tum.de>

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