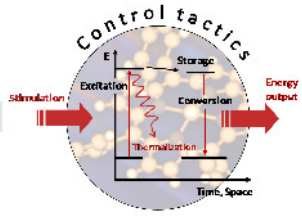

The Role of Electron Microscopy in Understanding Heterogeneous Catalytic Processes.

Robert Schlögl

Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin
Max-Planck-Institut für Chemische Energiekonversion, Mülheim a.d. Ruhr
www.cec.mpg.de/www.fhi-berlin.mpg.de

Heterogeneous catalysis is a strategic technology for our society with an actual focus on sustainable energy systems. Despite its importance and the fact that many Nobel awards were given for discoveries in this field we still lack a solid understanding enabling the rational finding of materials and processes as common in other strategic technologies.

One central issue is the fact that working catalysts are dynamical and form its active state only during interaction of reactants and catalysts. Another issue is the fact that the motion of atoms and the making and breaking of chemical bonds and thus stability issues are central part of the function of the materials, properties that are in physical and mechanical applications avoided.

The combination of morphological information on different length scales with spectroscopic information on the chemical state of reacting systems is the methodology to find the missing concepts in catalysis.

Electron microscopy in many forms plays a vital role in this effort as it can work with real samples, identify the most relevant non-translational symmetric structural components and can be used at several scales of space. Its inherent drawback is the limited ability to study in-situ processes. This is gradually changing. In addition the combination of experimental and theoretical information from several methods allows bridging this disadvantage rendering electron microscopy despite its handicap a central toolbox in catalysis science.