Electrocatalysis – Rotating Disk Electrodes

Decentralized supply of energy from renewable sources strongly relies on the efficient conversion and storage of energy in different forms, for example, in the form of H_2 by electrolysis of water and recovery of the energy during the reverse process in fuel cells and in rechargeable metal–air batteries. Reversible interconversion of water into H_2 and O_2, and the recombination of H_2 andO_2 toH_2O thereby harnessing the energy of the reaction provides a completely green cycle for sustainable energy conversion and storage. Whereas the reversibility of the electrochemical reactions involving H_2 in the case of regenerative fuel cells and reduced metal in the case of metal–air batteries is efficient, the main challenge lies in improving the efficiency of the oxygen reduction reaction (ORR) and the oxygen evolution reaction (OER).

In order to investigate new catalysts materials with respect to their ability to evolve or reduce oxygen linear sweep voltammetry using a rotating disk electrode are commonly used. In the practical, we apply this experimental technique for the determination of the onset potential of the oxygen evolution reaction for a non-noble metal catalyst. The underlying theory (Koutecky-Levich) and the influencing parameters on catalyst evaluation will be discussed.

References

R. A. Rincón, E. Ventosa, F. Tietz, J. Masa, S. Seisel, V. Kuznetsov, W. Schuhmann, *ChemPhysChem* **15** (2014) 2810-2816. Evaluation of perovskites as electrocatalysts for the oxygen evolution reaction

J. Masa, W. Xia, I. Sinev, A. Zhao, Z. Sun, S. Grützke, P. Weide, M. Muhler, W. Schuhmann, *Angew. Chem. Int. Ed.* 53 (2014) 8508 –8512. Mn_xO_y/NC and Co_xO_y/NC nanoparticles embedded in a nitrogen-doped carbon matrix for high performance bifunctional oxygen electrodes

A. Zhao, J. Masa, W. Xia, A. Maljusch, M. Willinger, G. Clavel, K. Xie, R. Schlögl, W. Schuhmann, M. Muhler, *JACS* **136** (2014) 7551-7554. Spinel Mn-Co oxide in N-doped carbon nanotubes as bifunctional electrocatalysts synthesized by oxidative cutting

J. Masa, A. Zhao, W. Xia, M. Muhler, W. Schuhmann, *Electrochim. Acta* **128** (2014) 271-278. Metal-free catalysts for oxygen reduction in alkaline electrolytes: Influence of the presence of Co, Fe, Mn and Ni inclusions