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ENERGYPOLIS SEMINAR

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Controlled synthesis and *in situ* characterization of nanoparticles and nanostructures

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The preparation and application of nanomaterials in the field of catalysis, energy storage, and gas sensing has been a topic of great interest. However, the preparation of nanomaterials with tailored structure and the understanding of their working mechanism remains a challenge. In this presentation, three projects aimed at controlled synthesis and *in situ* characterization of nanomaterials will be discussed. In the first project, non-spherical magnetic core-shell nanostructures with gold nanoparticles embedded between silica and carbon layers were prepared and characterized. It was demonstrated that the paramagnetic property of the final product is "*in situ*" obtained during the final calcination process, and thus the aggregation of magnetic particles in liquid phase was avoided. In the second project, a two-step electrodeposition process to fabricate a 3D CoS/graphene hybrid network with a nanosheet structure on Ni foam was developed. The nanosheet-like CoS is tightly wrapped and anchored by the graphene layer and the two different material species are nicely integrated together, leading to increased conductivity and enlarged electroactive surface area of the electrode materials, which revealed its promising potential in high performance supercapacitors. In the last project, the interaction between analyte gases and NH_3-selective MoO_3-based sensing materials was studied by *in situ* infrared spectroscopy. It was demonstrated that the surface acidity and oxidizing property play an important role in the selective sensing process. These findings are a basis for tailoring the selectivity of sensors by their surface properties

References:

[1] Li M, Li X, Qi X, Luo F, He G. Shape-Controlled Synthesis of Magnetic Iron Oxide@SiO2–Au@C Particles with Core–Shell Nanostructures. *Langmuir*. 2015;31(18):5190-5197.
[2] Shi J, Li X, He G, Zhang L, Li M. Electrodeposition of high-capacitance 3D CoS/graphene nanosheets on nickel foam for high-performance aqueous asymmetric supercapacitors. *Journal of Materials Chemistry A*. 2015;3(41):20619-20626.

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Born in 1988 in Shenyang, China, Mo Li graduated with a BSc and MSc in Chemical Engineering from Dalian University of Technology in 2012 and 2015, respectively. During this time, he conducted projects focusing on membrane technology for gas separation and the synthesis and characterization of nanostructures. He then went on to pursue PhD studies in ETH Zurich in 2015. There, his research focused on the development of highly stable CaO-based CO2 sorbents and understanding the interaction of gases with the surface of metal-oxide gas sensors by *in situ* infrared spectroscopy.