universität wien
Department of Functional Materials and Catalysis
Institut für Funktionelle Materialien und Katalyse

Engineering and characterization of nanoparticle bio-nano-interfacial interactions for enhanced functionality (and some other things too)

Mika Lindén (Inorganic Chemistry II, Ulm University, Ulm, Germany)

Guest Lecture

Date & Time: Sept 18, 10-11:30 Uhr
Place: Seminarraum 2, 1. Stock, Währinger Straße 42
Host: Univ.-Prof. Dr. Freddy Kleitz

Abstract
Nanoparticles of different types are attracting immense interest for use as drug carriers and for diagnostics as they may allow formulations exhibiting enhanced biostability, biodistribution, and bioavailability of the drug or contrast agent, as well as allowing high local dosing at low systemic burden in combination with prolonged release. However, despite decades of intense research, very few formulations have made it into the clinic. One of the obstacles on the way from the bench to the bedside is the often sub-optimal specificity and biodistribution *in vivo*, which in turn is largely a result of a relatively poor understanding of the influence of the protein corona forming on the surface of any material in contact with serum on the biological response of the materials. Only during the recent years more focus has been put on trying to actively and rationally modify the protein corona through pre-treatments of the particles in order to enhance their performances in complex biologic media in terms of optimizing interactions with target cells and organs/tumors, as well as with the defense system of the body, especially the removal of nanoparticles from the blood stream by macrophages present in the liver and spleen and also by endothelial cells. Another important aspect of protein corona engineering is to ensure that the nanoparticles maintain their cellular selectivity when active targeting is aimed for, as well as to influence the intracellular fate of the nanoparticles in terms of trafficking and endosomal escape. The lecture will cover all these aspects mainly using mesoporous silica and superparamagnetic iron oxide nanoparticles as nanomaterial platform. Special focus will be put on results related to direct analysis of ligand-receptor interactions as a function of ligand and receptor concentrations, and on adsorption-driven surface functionalization of nanoparticles through adsorption of functional proteins or cellular membranes.
The last part of the lecture will be covering issues inherently related to the wet synthesis of mixed metal oxides through precipitation, which may lead to unwanted, but often ignored, local differences in chemical composition due to differing solubility constants of the metal salts. Here, a metal carbonate-based synthesis of $LiMn_{1.5}Ni_{0.5}O_4$ will be used as example, and a direct influence of synthesis-derived inhomogeneities on its electrochemical performance as cathode material in Li-cells will be demonstrated.