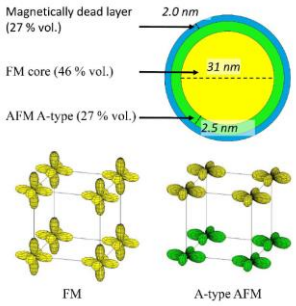
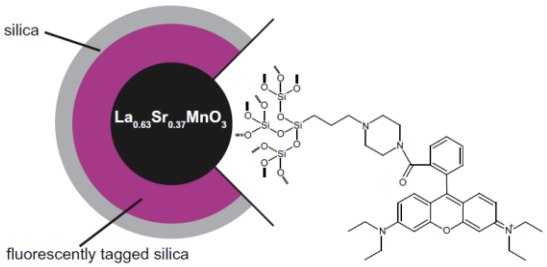
GESELLSCHAFT DEUTSCHER CHEMIKER

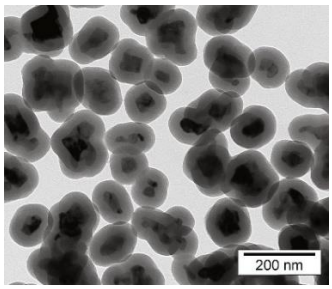
Ortsverband Kaiserslautern

V O R T R A G S A N K Ü N D I G U N G



$La_{0.63}Sr_{0.37}MnO_3$ nanoparticles





Dr. Ondřej Kaman

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From magnetic nanoparticles to molecules

While decreasing the size of particles, magnetic properties of diverse materials are changing and novel phenomena, such as the superparamagnetic behaviour, emerge due to the finite-size and surface effects. Even new polymorphs can be achieved, which is exemplified by the famous case of ε-Fe_2O_3. Moreover, in ensembles of monodisperse magnetic nanoparticles, collective states can arise due to magnetic interactions among the particles. Although the field of magnetic nanoparticles seems to be dominated by the solid-state science, molecules and chemistry of molecular compounds are equally important for it. Not only interesting analogies between nanoparticles and molecules can be provided, but functionalization with molecular compounds is usually indispensable for the application of magnetic nanoparticles in medicine, sensing and catalysis.

This overview will summarize our recent efforts devoted to the development of magnetic nanoparticles based on transition metal compounds for advanced applications. We will show how magnetic properties of nanomaterials depend on (i) the crystal structure and composition, (ii) the size of particles and their aggregation state and (iii) the core-shell structure of composite particles and nanostructuring. We will also show how magnetic properties can be precisely tailored to a given application based on these factors. Our model examples will include perovskite phases of $La_{1-x}Sr_xMnO_3$ within the ferromagnetic metallic region ($0.2 \leq x < 0.5$), nanoparticles of Mn-Zn ferrite and substituted magnetite phases, i.e. spinel structures with the ferrimagnetic arrangement, and the fascinating ε-Fe_2O_3 phase with a giant coercivity, together with its doped counterparts. The synthesis of these nanoparticles will be discussed as well, but larger attention will be paid to the next step. Namely, we will touch on the surface modification of magnetic nanoparticles by diverse procedures, including complex organic functionalization and synthesis of gold nanoshells, thus illustrating the rich chemistry associated with the development of novel biomedical and analytical tools.

Importantly, we will see various analogies and links to the world of molecules and coordination compounds. In addition to magnetic and structural transitions in solid-state systems, the talk will include also a transition from the topic of magnetic nanoparticles to the topic of molecules and an outlook regarding the future.

Dienstag, den 24. Januar 2023 — 17.15 Uhr

Gebäude 52 — Hörsaal 206

Gäste sind herzlich willkommen

gez.: Prof. Dr. Antonio Pierik