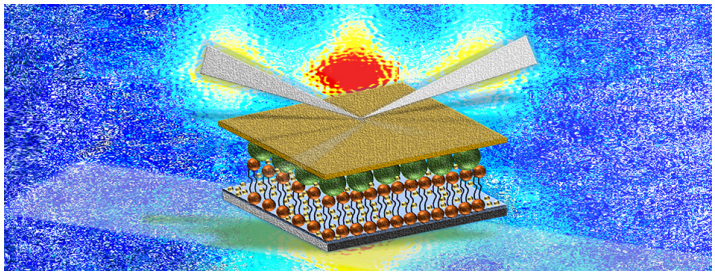

Beitrag ID: **15** Typ: **Invited talk**

Magnetization distribution in core/shell magnetic nanoparticles

Mittwoch, 9. Oktober 2024 15:30 (30 Minuten)

In single-domain nanoparticles (NPs), magnetic anisotropy significantly influences crucial properties in crafting magnetic nanocrystals for high-density data storage or medical purposes[1]. Success in designing systems to fulfill these applications requires a fine tune in the magnetic properties of the NPs, which is directly related to the control of the composition and morphology of the system. In particular, the development of fabrication techniques of systems with complex architecture, such as core/shell or even onion-like multiphase NPs, gives new degrees of freedom to tune specific physical-chemical properties by combining materials with different compositions and magnetic characteristics and providing new perspectives for their potential applications. Another original yet uncommon strategy is boosting the magnetic anisotropy via anchoring magnetic spin crossover (SCO) molecules on the particle surface[2,3,4]. However, the characterization with traditional and affordable techniques is challenging, and the spatial probe is necessary to unveil nuclear and magnetization fluctuation at the nm length scale. Within this contribution, I will present our latest results on different core/shell NP systems. In this context, I will demonstrate the magnetic small-angle neutron scattering technique as a unique and powerful tool for elucidation of the nanoscale magnetization with a spatial resolution[5,6], allowing us to uncover and disentangle the magnetization within these complex nanostructured materials. Firstly, I will present the changes in magnetization within the 2 nm ferrimagnetic shell in the FeO/Fe_3O_4, $CoO/CoFe_2O_4$ core/shell NPs and explore the influence of the core's magnetic state below and above the Néel temperature on the shell's magnetization response. Later, I will focus on the more complex NP system with a ferromagnetic core of ε-Fe_3N and an oxidic shell layer of unknown stoichiometry Fe_xO_y, revealing the unexpected magnetic response of the oxidic shell. Finally, I will introduce a novel core/shell system with a ferrimagnetic $CoFe_2O_4$ core and NH_2-functionalized iron-triazole SCO molecule as a shell, emphasizing the core's coupling and influence on the SCO's response.

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