A journey with the nuclear probes ^{57}Fe and ^{161}Dy from single domain particles to single molecular magnets

Volker Schünemann

Fachbereich Physik, RPTU Kaiserslautern-Landau

Superparamagnetic iron particles have a broad field of applications. Depending on their size and support they be used as magnetic drug carriers, in magnetic hyperthermia therapy and last but not least in catalysis. They can act as magnetic carriers of sustainable reusable catalysts or as catalysts themselves. One of the most remarkable applications of iron catalysts are the Haber-Bosch-process and the Fischer-Tropsch process. Mössbauer spectroscopy can be used not only to determine catalytically active iron phases it can also be used to identify superparamagnetic iron particles and to determine particle sizes. In the first part of this contribution an overview over the potential of the application of the Mössbauer Effect in catalysis will be given from zeolite supported model catalysts for Fischer-Tropsch reactions through examples of magnetically separable nanocatalysts that bridge the gap between homogeneous and heterogeneous catalysis, to the identification of active sites in iron-based DeNOx catalysts.

The status of the iron phases in heterogeneous catalysts is unclear from the outset for most catalysts. This justifies scientific efforts to identify the phases, ions or agglomerates that are catalytically active. Iron containing molecules are inherently well defined and allow to study magnetic and dynamic effects in a much better sense. Therefore, in the second part of my talk I will give an overview about our recent work on molecular systems which shows single molecular magnetism using not only the nuclear probe ^{57}Fe but also ^{161}Dy.