

# **Metal Oxide Nanoparticles with Tailored Properties through Chemical Synthesis and Functionalization**

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Metal oxide nanoparticles are already used in various applications, ranging from flowing aids and abrasives to the UV-protecting component in sunscreens. Future applications however could utilize nanoparticles in a much more sophisticated way, employing “intelligent” nanoparticles that are for example programmed to fulfill special functions in the human body or self-assemble to structures like electronic circuits. Such applications require nanoparticles of defined size and shape as well as a controlled surface chemistry – the nanoparticles must possess tailored properties in order to be able to tap their full potential in a specific application. This can only partially be realized with the current synthesis methods, and whilst numerous examples for the fabrication of nanomaterials with very different properties have been presented, the rational synthesis of nanoparticles with specific properties is not possible yet. In this presentation, it will be shown on the example of nonaqueous sol-gel synthesis how a thorough understanding of the formation processes and mechanisms can provide tools for the tailoring of nanomaterials with respect to all major properties, particularly crystal phase, size and morphology, and surface functionality, that are relevant to applications. In several examples, it is demonstrated that this concept additionally paves the way for novel applications.