

**Chemically Designed Nanomaterials:  
Controlled Growth, Applications and Devices**  
Sanjay Mathur\*

*Leibniz-Institute of New Materials, Saarland University, 66041 Saarbruecken, Germany*  
*Department of Chemistry, Wuerzburg University, 97074 Wuerzburg, Germany*

---

Availability of high-purity nanophase materials exhibiting specific properties, tailored shape and microstructure is essential for transforming the developments of nanoscience into nanotechnology. Despite extensive research in the synthesis and processing of inorganic materials, producing nanoscaled matter with precise control over chemical composition, morphology and microstructure remains an overarching task. The conventional synthesis of inorganic compositions, controlled by diffusion of ionic and atomic species through both reactants and products, is rather crude for the unit-by-unit assembly of nanostructures. Given the inherent limitations of traditional material processing routes, we are developing chemical concepts for a designed materials synthesis and evaluating their applications in chemical nanotechnologies.

Since molecular level synthesis of inorganic materials is not a predictive science, it is difficult to anticipate the phase structure and properties of the resulting solid from the knowledge of the chemical design. This talk will present how chemically processed nanoparticles and nanowires of different metal oxides open up new vistas of material properties, which can be transformed into advanced material technologies. The examples will include application of superparamagnetic iron oxide nanoparticles for drug delivery applications and development of single-nanowire based devices.

---

---

\*Corresponding Author.

*Email Address:* sanjay.mathur@inm-gmbh.de (Sanjay Mathur)