Nanostructures for Energy Application:

Synthesis, Characterization and Advanced Applications

The primary focus of our research activity is development of novel nanostructures for optical, electrical, biological and energy application. Our Laboratory studies the science of optimally preparing and characterizing metal, semiconductor, magnetic, insulating inorganic nanostructures, and multi-component nanostructures with various interfaces, including nanocrystals, nanotubes and nanowires with controlled size, shape, and composition. The synthesis of 1-dimensional nanostructures is conducted by gas- and solution-phase, where we develop our own approaches to achieve new nanomaterails and a better control of the synthesis parameters. The research encompasses the design and synthesis of precursors, the study of microscopic elementary processes in nanostructure nucleation and growth, and the use of nanostructures in functional, multi-component devices.

The applications our group focuses on are catalysis and solar energy conversion from nanomaterial composite systems. As catalysts, nanomaterials could improve product selectivity, thereby reducing chemical waste and produce cleaner fuels. As energy conversion materials, they could lower the final cost per kWh to the end user. From precursor design to impact on the environment, we examine the possible contributions nanomaterials could have on our world.

The ongoing projects are:

Selected research topics:

* Developing novel approaches to synthesize nanostructures with a special focus on large scale synthesis.
* Synthesis of metal, metal-oxide and semiconductor nanoparticles
* Shape and composition Control of nanostructures
* Synthesis of nanowires and other structures using gas phase techniques
* Synthesis of multi-component nanostructures and assembly
* Nanostructures-based composites for solar energy applications (Photovotaic and photoelectrochemical cells)
* Hybrid nanocatalysis
* Studying the impact of nanocrystals on the environment
* Structural, chemical, optical, and electrical characterization of inorganic nanostructures