Synthesis And Self-Assembly Of Nanoparticles

Horst Weller[1]

[1] University of Hamburg
Institute of Physical Chemistry
Bundesstrasse 45
Hamburg 20146
Germany

This talk describes recent developments in the synthesis and characterization of semiconductor and metal nanoparticles. Results on the growth kinetics and the control of size, shape and surface chemistry will be addressed. We present Monte Carlo simulations of an ensemble of growing particles showing that optimal conditions for the synthesis of highly luminescent semiconductor nanoparticles are maintained if the exchange rate of monomers at the particles' surface is high during the growth. Energy-dependent XPS studies allow to distinguish surface atoms from bulk atoms within the nanoclusters. It is shown how chemical surface modification yielding highly luminescent particles removes surface states which are obviously responsible for non radiative recombination. Examples for 2D and 3D self assembly of nanoparticles are given. We report on the formation of colloidal crystals from semiconductor and magnetic nanoparticles. In mixtures of differently sized particles complex 3D structures are formed which are analog to inter-metallic phases. Self assembly of ZnO nanoparticles in solution finally leads to the formation of single crystalline nanorods via oriented attachment.