

Aerosol Nanoparticle Synthesis without Chemical Reactions

Prof. F. Einar Kruis

Institute for Technology of Nanostructures and Center for Nanointegration Duisburg-Essen,
University Duisburg-Essen, Germany

The chemistry-free synthesis of nanoparticles in the gas-phase has a certain number of advantages in comparison to synthesis based on precursors and chemical reactions, which will be elaborated in this talk. After a short discussion of nanoparticle synthesis by physical methods, the talk will be guided by an extensive description of its' main challenges, namely costs, energy consumption, stability of generation, product stoichiometry, control methods, scaling-up and integration in other processes. A number of examples will be given, especially for arc and spark discharge which are characterized by simple power supplies, beneficial both for laboratory operation as well as scaling-up purposes. The characteristic energy consumption of these processes will be described, as this is essential for the final product costs. The abilities for monitoring production rate and product quality are important requirements for industrial production, as well as methods which allow to control particle size, the material stoichiometry and mixing ratio. Strategies to maximize the production rate as well as scaling-up examples will be shown. Finally, two examples of integration a chemistry-free nanoparticle generator into a subsequent material synthesis process will be given, size-selected nanoparticles for the aerotaxy process as well as incorporating particles into a PVD film at low pressures.