Field of activity

Investigations on the behavior of nanoparticles in thermal processes

Synthetic nanoparticles are included in a variety of products to achieve specific product properties. However, the formation, behavior and release of such nanoparticles during recycling and end-of-life recovery is still largely unexplored.

In the working group, basic investigations are mainly carried out on the thermal behavior of nanoparticulate metal oxides, which are generally considered to be thermally inert, but investigations in hazardous waste incinerators have shown that chemical reactions also have to be considered. Model materials such as titanium dioxide or cerium dioxide are dosed into the flame of laboratory burners and the thermal or chemical reaction on the particles is investigated.

These investigations have shown that, depending on the temperature, new particles with a much lower modal value than the added starting material can be formed. This suggests the suspicion of a chemical reaction in the flame, which is why investigations were carried out in a high-temperature tube furnace with variation of the atmosphere.

To fully interpret the experimental studies, extensive particle measurement technology is needed for characterization. This includes sampling techniques, imaging analysis (TEM, SEM, EDX), but especially on-line measurements of particle distribution using Scanning Mobility Particle Sizer (SMPS) and Electrical Low-Pressure Impactor (ELPI).

In addition to the basic experimental investigations, the laboratory flames used are simulated, calculations and measurements of the temperature distribution of the flames are carried out using Chemkin and CARS measurements, and the behavior of the nanoparticles is simulated in kinetic models using CFD.

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