Carl von Ossietzky
Universität
Oldenburg

Institut für Physik

Physical Colloquium

„Hetero aggregations of particulate systems and their properties“

Prof. Dr.-Ing. habil. Lutz Mädler
University of Bremen, Production Engineering,
Particles and Process Engineering group

Monday, 09.12.2024, 2.15 p.m.
Room No. W02 1-148

Essential key technologies, for example in the context of digitalization for Industry 4.0 (sensor technology), energy conversion (catalysis) and energy storage as well as e-mobility (battery technology) or also life science, depend on functional disperse particle systems with very specific functional properties. Particles are rarely present individually and isolated, but mostly as powder or heap. Interactions occur between the various particles at their points of contact. If particles of different materials (for example A and B) are present, contacts between different (hetero: A-B) particles can occur. These hetero contacts (A-B) are of fundamental importance for the functional properties. These are essential for many applications. But how can such hetero contacts be created specifically by mixing A and B and how can these contacts be made visible or measurable?

In our work the preparation and formulation of hetero-contacts in the gas phase is realized through the combination of two nanoparticle aggregate producing flames in a double flame spray pyrolysis (DFSP) setup. The product functionality depends on the degree of mixing that determines the number of hetero-contacts and on the hetero-contact quality. The hetero-contact quality significantly depends on the contact area and on the atomic structure of the interface including lattice strain and defect chemistry, if interfacial transport processes govern the functionality. The variation of DFSP process parameters enables the adjustment of the mixing process and resulted in improved functionalities in various applications. However, the characterization of the hetero-contacts on the aggregate and particle scale is far from understood, where the small size of the primary particles of about 10 nm requires the use of transmission electron microscopy (TEM) imaging to achieve a sufficient resolution of the structures.

Host: Prof. Dr. Kerstin Avila