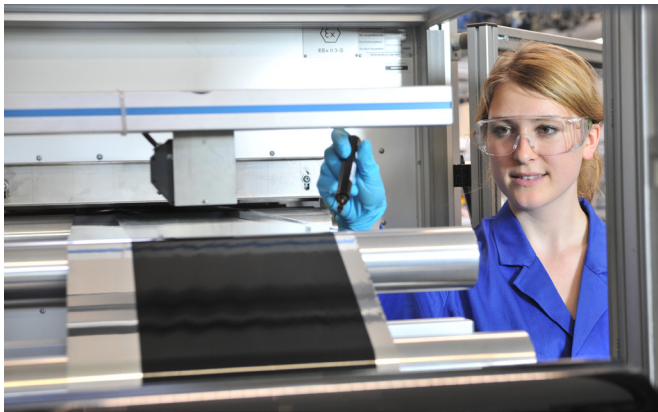


Battery process engineering

The research unit battery process engineering deals with procedural aspects of electrochemical storage technologies, from basic research to process and manufacturing technology for the industrial production of electrodes. The following research topics are covered:

- Pre-treatment of particles
- Mixing, dispersing and formulation
- Coating and calendaring
- Cell manufacturing, electrochemistry and simulation
- Recycling (process development and parameterisation)



Pharmaceutical process engineering

This research unit is focused on the development of pharmaceutical product formulation strategies and production techniques. The fundamental comprehension of formulation ingredients and their mutual interactions as well as a profound understanding of the manufacturing processes from an engineering point of view, provide strategies for the development of effective and cost-efficient medicines. Special focus is set on:

- Granulation and tablet compaction
- Formulation of poorly soluble API and biomolecular drugs
- Mechanical production techniques
- Innovative dosage forms for personalized medicine



Technische
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iPAT
Institute for Particle Technology

Consultation services

Based on our research experience, we offer expert consultation services in diverse fields closely linked to our focus areas.

Measurement services

Measurement services are provided for industrial and academic applications, focused on the analysis of particle sizes, mechanical properties or particulate structures as well as rheological properties.

Research and Development

The Institute for Particle Technology has long experience on applied research projects with and for industrial partners. Small R&D projects are as well possible as long-term cooperations.

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Equipment and research services

Institute for Particle Technology

Grinding and dispersing

Research on grinding and dispersing has a long tradition at the Institute for Particle Technology. A deep process understanding was generated during the past decades and many different devices are available for industrial products, such as:

- Different types and sizes of ball and stirred media mills
- Impact mills for dry grinding
- Rotor-stator dispersion systems
- High pressure homogenization
- Ultrasound dispersion
- Kneading and extrusion

Dry powder characterization

Powder characterization is a crucial element of particle technology in order to characterize disperse properties as well as bulk solids behavior for process or silo design. Several techniques and self-developed or improved characterization methods are available :

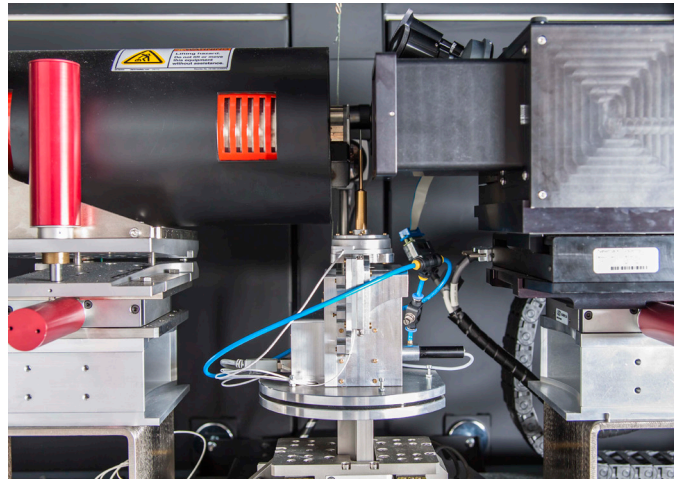
- Particle size analysis (sieving, image analysis, laser diffraction)
- BET, Blaine and pycnometry
- Surface energy analysis
- Shear testing (ring shear tester and Jenike cell)
- Micro shear tester for small amounts (coupled with μ -CT)
- Silo centrifuge and anisotropic tester



Suspension characterization

Many different methods for suspension characterization are available at the institute for particle technology, disperse properties can be characterized as well as physical properties :

- Particle size analysis from nm to mm (dynamic light scattering, laser diffraction, ultrasound spectroscopy, sedimentation and image analysis)
- Zeta-Potential measurement
- Rheology
- Tensiometry



Structure analysis and mechanical testing

Particulate systems and structures can be characterized with respect to their mechanical properties, composition or structure by various testing methods:

- Micro-computed tomography
- Electron microscopy (REM, TEM)
- Atomic force microscopy (AFM)
- Surface profilometry
- Material testing device
- Micromechanical testing by nanoindentation
- Hg-intrusion porosimetry

Coatings and solid structures

The production of coatings and solid structures based on different particle processing technologies is a main research focus of the institute for particle technology, several processing technologies are available:

- Spray drying
- Mixing equipment (dry and wet)
- Fluidized bed agglomeration and drying
- (Nano-)composite formation
- Tablet compression and compaction simulation
- Roll compaction
- Coating (dip-, spin- and spray-coating, doctor blade)

Simulation and modeling

Simulation and modeling provide essential tools for process design and optimization. These methods reduce experimental effort, support physical understanding and enable the prediction of experimental results. Different tools are available at the institute:

- Computational fluid dynamics (CFD)
- Discrete element simulation (DEM)
- Finite element simulation (FEM)
- Population balance modeling (PBM)
- Flow-sheet modeling
- Mechanistic process models e.g. for stirred media mills

Particle synthesis and functionalization

Tailored nanoparticles can be produced by bottom-up methods using sol-gel or precipitation techniques. Additionally particle surface properties can be modified by targeted functionalization for special applications.

- Lab scale synthesis with different reactors
- Inert-gas powder handling
- Thermogravimetric analysis (TGA), infrared spectroscopy (IR) and UV-Vis Spectroscopy
- X-ray diffraction (XRD) , small angle x-ray scattering (SAXS)