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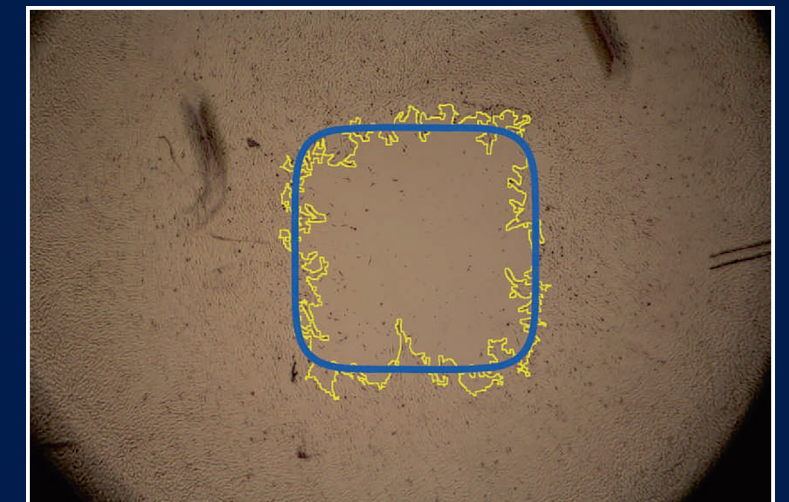
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- the application of modern tools such as protein and enzyme engineering in biochemical engineering;
- systems biology;
- the use of biology to effect a transformation of material;
- waste treatment;
- bio-reaction engineering;
- high-throughput process development;
- simulation of molecular and process performance;
- downstream processing;
- bioreactor modeling.

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- Chemical engineering of materials synthesis, characterization, design, control, and scale up of materials synthesis
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- Synthesis-structure-function relationships of materials or material classes
- Nucleation and growth (or formation) mechanisms of materials

Particle technology – Chemical engineering process steps to manipulate the properties of particles and particulate systems:

- Flow measurement and tomography of particulate processes;
- Fluidization and fluid-particle systems;
- Novel particle synthesis, surface functionalization, production, and characterization;
- Modeling and simulation for fluid dynamics of particulate systems in chemical processes;
- Nucleation, growth, breakage and aggregation, particle population dynamics.

Process systems engineering

- Simulation, analysis, synthesis, optimization, and control of (bio-)chemical process systems based on mathematical modeling approaches;
- Advanced modeling strategies for all levels of the process systems hierarchy (molecular level, phase level, process unit level, plant level; enterprise level);
- Advanced methods for model and parameter identification;
- Methods for the design of experiments in chemical engineering.

Reaction engineering and catalysis

Simulation and experiments on

- reaction kinetics;
- catalyst synthesis, characterization and application;
- reactor design;
- process reaction intensification;
- multifunctional, micro- and multiphase reactors;
- molecular and quantum scale phenomena;
- density functional theory;
- multiscale modeling;
- transport phenomena related to multiphase reactors.

Separation processes

- general principles: phase equilibria, mass transfer, mixing and phase segregation;
- processes and unit operations: distillation, absorption, liquid-liquid extraction, membrane processes, adsorption separation processes, ion-exchange, preparative chromatography, crystallization and precipitation;
- supercritical fluid separation processes;
- biochemical separation processes;
- equipment design.

Thermodynamics and Soft Matter

Fundamental studies in thermodynamics and physical chemistry that have ultimate application in chemical engineering, including:

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- phase diagrams and the estimation of partial excess properties;
- emulsions, foams and the behavior of surfaces including fluid-fluid interfaces;
- colloidal and self-assembled systems;
- studies purely based on observation or reporting data that do not provide fundamental insight are discouraged; studies that bring fundamental understanding through modern analysis including molecular simulation are encouraged.

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