

Structuring and Stabilization of Suspensions by Scalable Process Routes



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2011

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Chemistry

New Markets, New Demands

- Sale of systems (i.e. function and chemicals), e.g.
 - Organic electronics
 - Heterogeneous catalysis
 - Controlled release of active agents

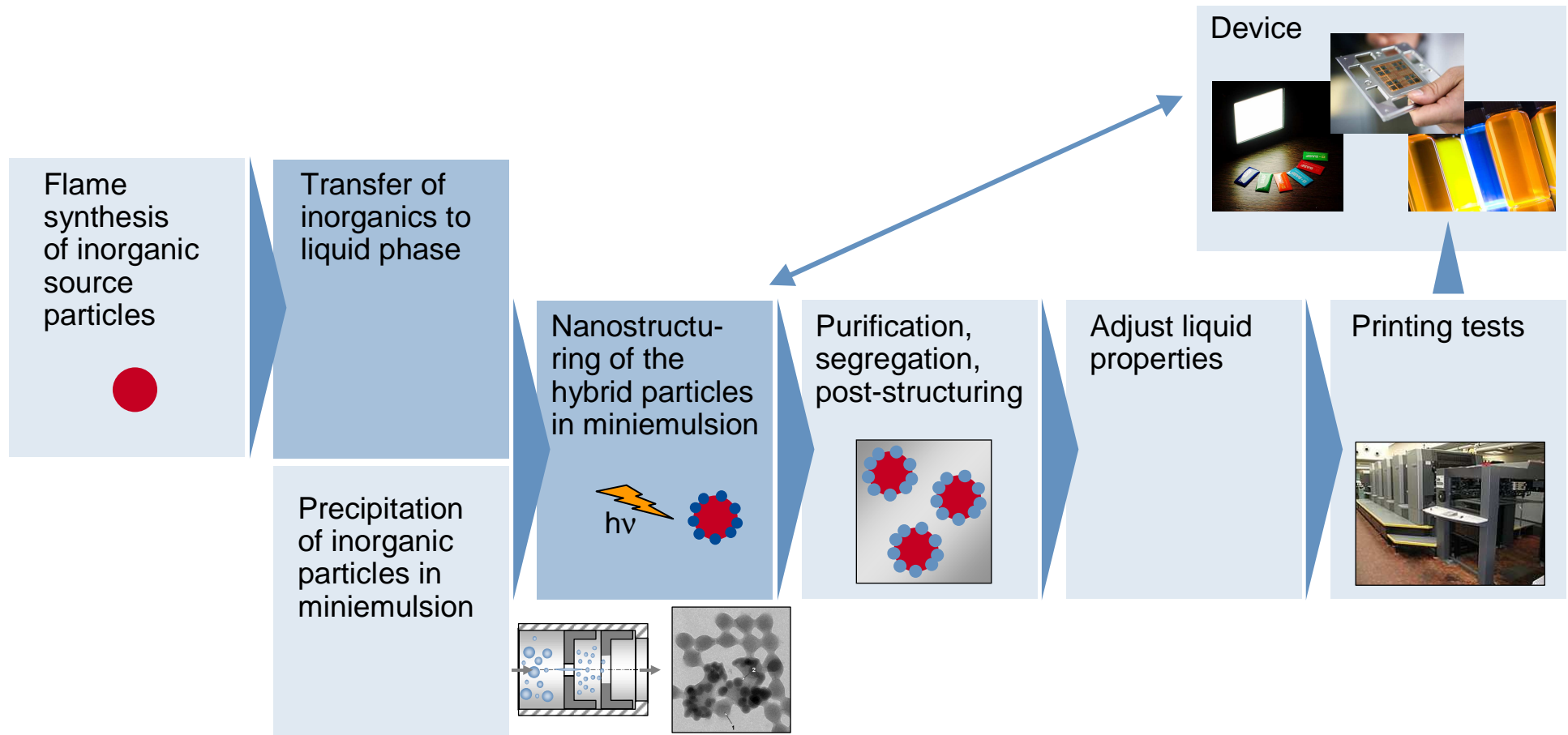
- Joint developments with customers and users
 - Multifunctionality
 - Formulation
 - Ready for application

- Individual products and technologies
 - More scope/need for design in the processes
 - Varying technical scale
 - Function ↔ Structure ↔ Process
 - Fundamental correlations are important



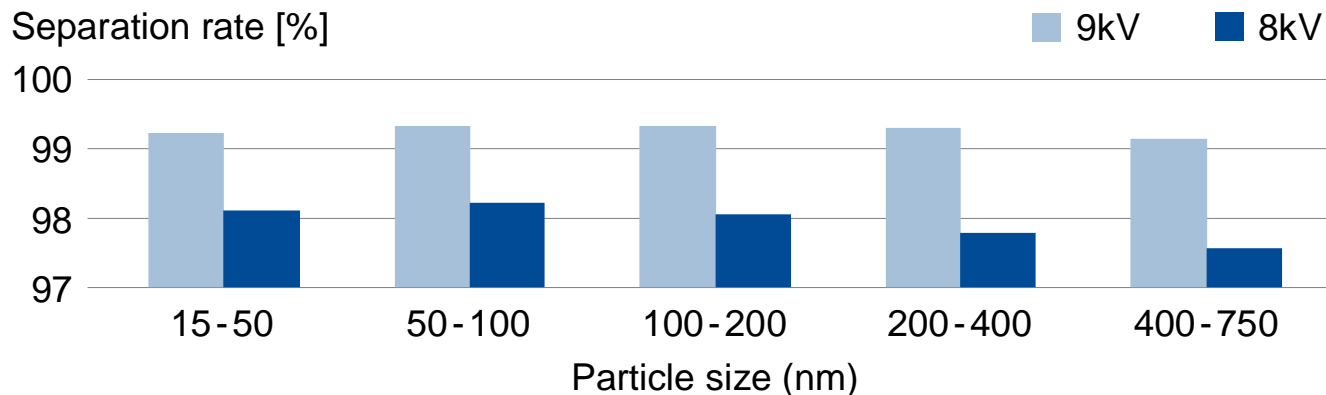
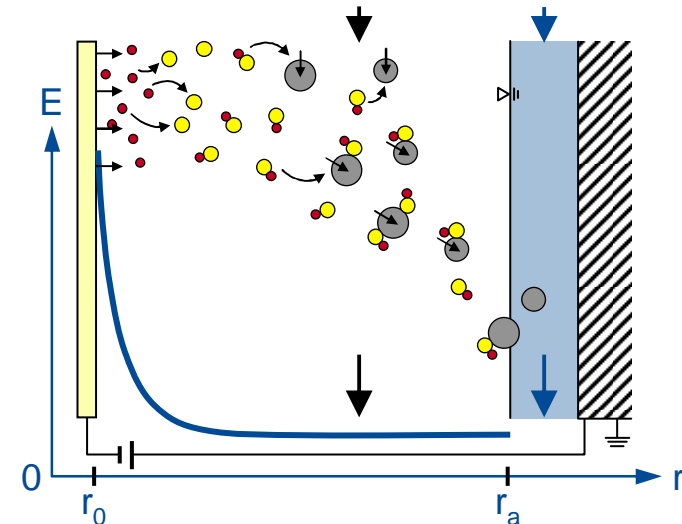
Hybrid Materials for Organic Electronics Integrated Process ...

... from particle birth to final application-ready formulation



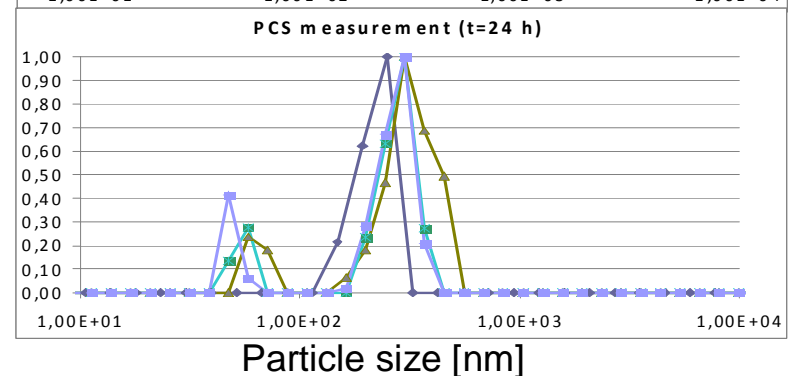
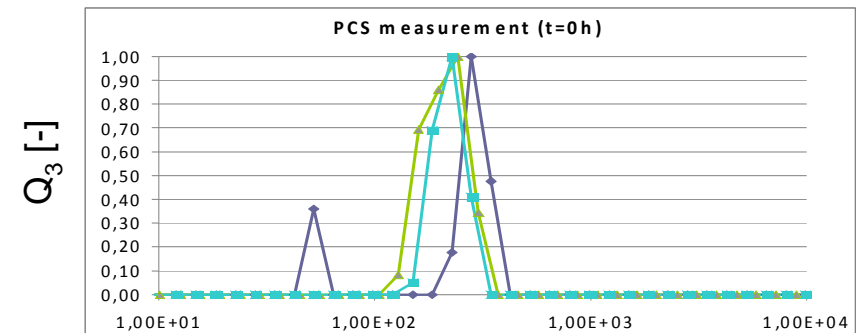
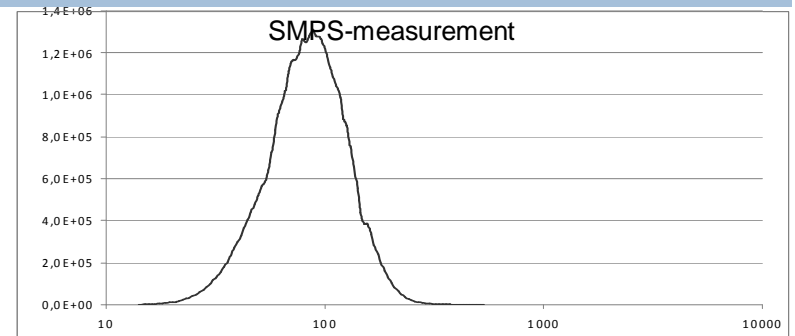
Transfer to Liquid Phase

- Wet electro filter
 - ▶ Continuous operation
 - ▶ Decoupled aerosol and suspension processing
- High particle concentration in aerosol (10^8 particles/cm³)
- No deposition minimum in MPPS region



Particle Size Distribution of Metal Oxides in Aerosol and Suspension

- Flame synthesis of oxidic particles
- Continuous deposition in wet electro filter
- Accumulation in liquid phase
 - ▶ Concentration of suspension: 2 %
 - ▶ Particle size measurement in gas phase (SMPS) and liquid phase (PCS)
- Stable suspension
 - ▶ Deposition near isoelectric point
 - ▶ Only slight agglomeration tendency

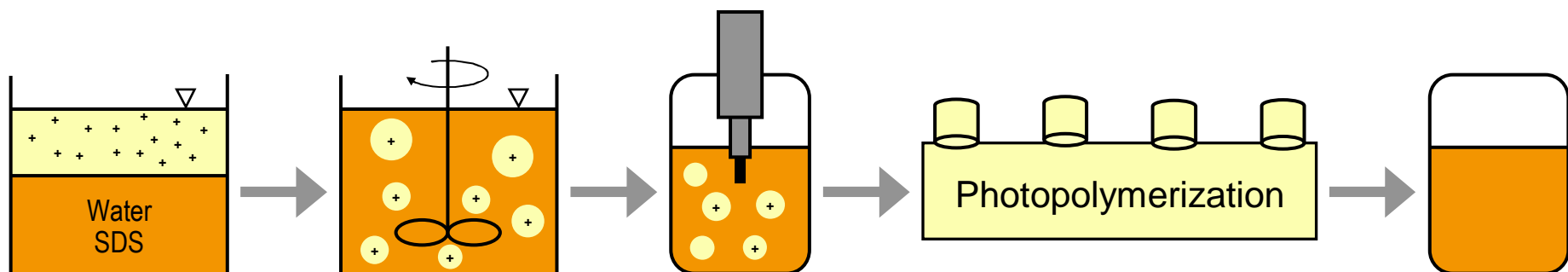
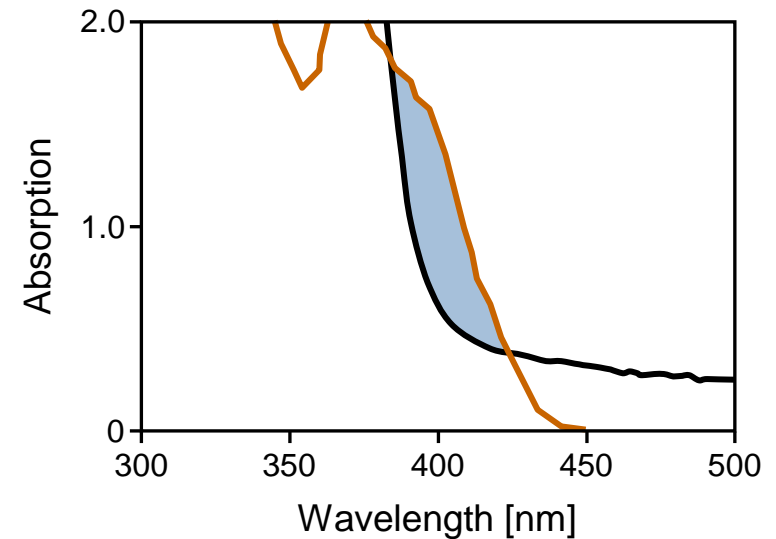


Particle Structuring by Photopolymerization in Miniemulsion

■ Requirements

- ▶ Compatibility of particle suspension with photoinitiator
- ▶ Polymerization in monomer droplets

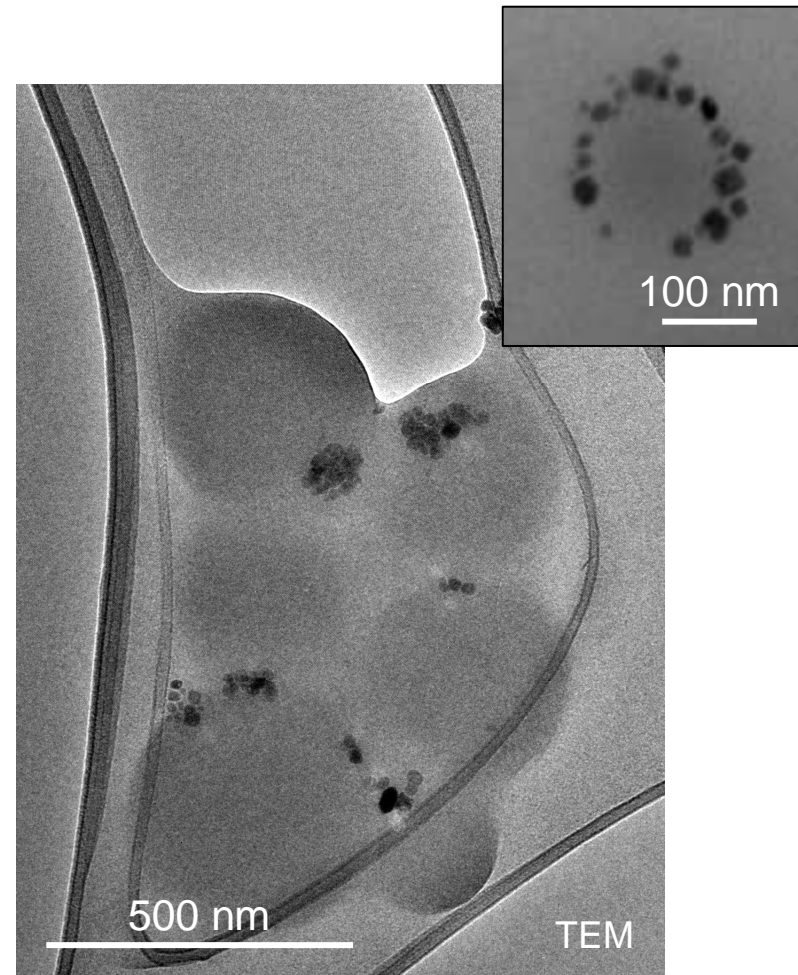
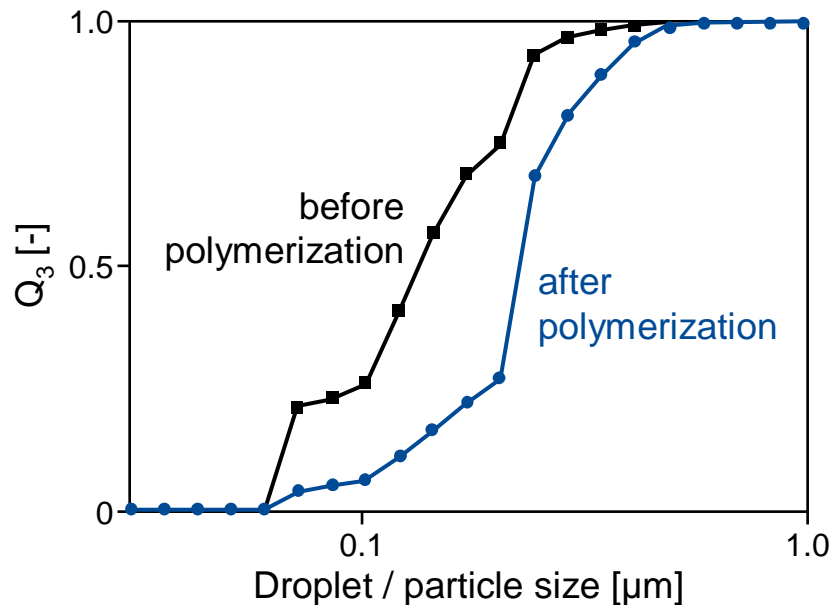
■ Reactor design



Aqueous Suspension of Nanostructured Particles

■ First results

- ▶ Particle size maintained
- ▶ Miniemulsion photopolymerization
- ▶ SDS stabilizes monomer suspension droplets and nanostructured particles



Summary & Acknowledgement

- Development of system-ready material systems
 - ▶ Formulations of nanostructured materials
 - ▶ Necessary is the production in scalable and integrated processes
- Wet electro filter = concept for full transfer of particles from aerosols to stable suspensions
 - ▶ Sustainable process without powder handling
- Miniemulsion technology = appropriate method for generation of homogeneous particle structures
- Combination for homogeneous functional materials for organic electronics



Supported by a grant from
the Ministry of Science,
Research and the Arts of
Baden-Württemberg
(Az: 33-729.61-3)

SPONSORED BY THE



Federal Ministry
of Education
and Research

(Grant No. 13N10296)



The Chemical Company