



NANOMATERIAL

**DESIGN, COLLOID AND
SURFACE RESEARCH
IN TURKU, FINLAND**

CONTROLLED
SURFACES AND
NANOSTRUCTURES

Physical Chemistry at Åbo Akademi University **offers expertise in**

- Colloid chemistry and dispersion technology
- Surface science and technology
- Materials design and processing
- Computational chemistry
- Sol-gel processing of inorganic nanostructured materials
- Surface characterization and functionalization



In the fields of materials, colloid and surface chemistry we

- Do high-quality research on functional materials and nanostructures
- Educate university students in our multidisciplinary subject
- Provide characterization services with a broad range of unique tools

We study, develop and design novel nanomaterials for various applications

- Energy harvesting and storage
- Biomedicine and diagnostics
- Dispersion technology
- Separation and membrane technology
- Construction industry

We can explain why things occur!

Collaborators:

- Ian Wark Research Institute, University of South Australia, Australia
- Lomonosov Moscow State University & General Physics Institute, Russian Academy of Sciences
- Nano Biomedical Engineering Research Center, Med-X Research Institute, Shanghai Jiao Tong University, P.R. China.
- Institute for Surface Chemistry (YKI), Sweden
- RCAST, University of Tokyo, Japan
- The University of Alabama, USA
- University of Ulm and University of Paderborn, Germany
- Finnish universities and institutes
- Chemical, pharmaceutical, diagnostic, paper and construction industry

Center of excellence

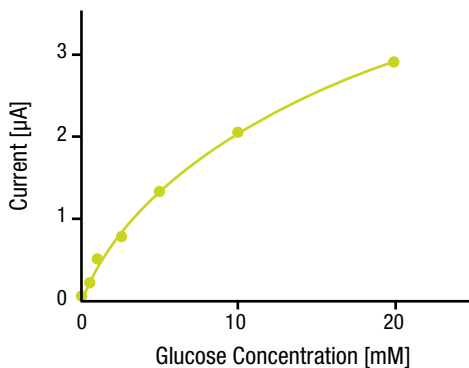
The National Center for Functional Materials (FUNMAT) is a Center of Excellence in printed intelligence located at Åbo Akademi University and University of Helsinki.

The center combines expertise in chemistry, physics, polymer technology, paper coating and printing to develop functional materials and devices within printed intelligence. The multidisciplinary research is closely cooperative with industry and our wide global scientific network.

We develop novel materials to be processed by mass manufacture technology like printing on flexible substrates (paper, polymer).

The applications include:

- Sensors
- Indicators
- Electronics
- Individualized dosing of medicines



Response of a printed electrochemical sensor for glucose detection

Printed gold and silver/silver chloride electrodes on paper for e.g. electrochemical biosensors

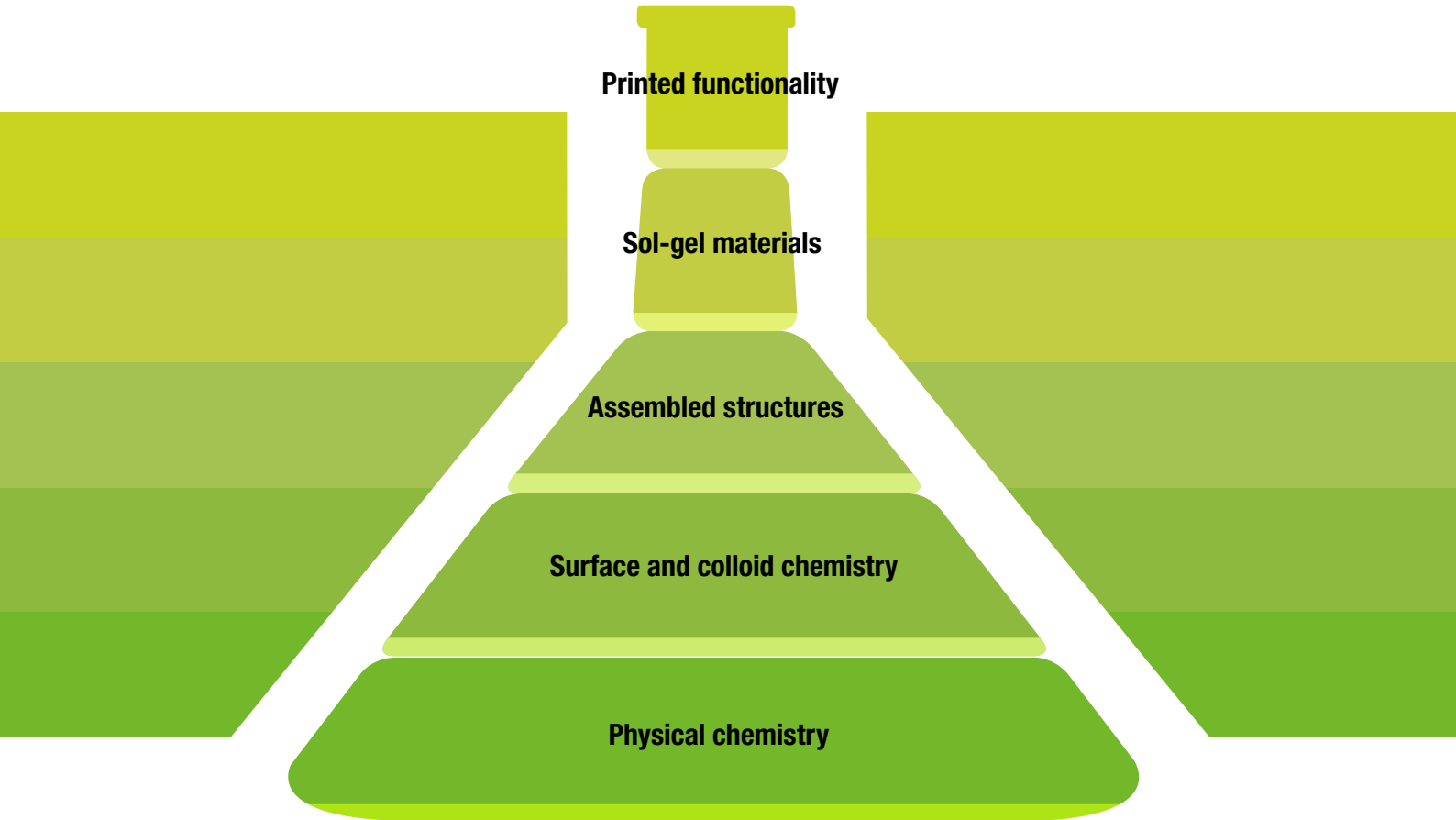


FUNMAT partners:

- Physical Chemistry (ÅAU)
- Polymer Technology (ÅAU)
- Paper Coating and Converting (ÅAU)
- Physics (ÅAU)
- Polymer Chemistry (University of Helsinki)



Core competence



The performance of any material is defined by its physico-chemical interfacial and interactive properties; which are determined by geometry, structure, porosity and surface chemistry down to a molecular level. We can tune these parameters for designing high-performance materials with a desired functionality.

Applications

Pharmaceutical and energy applications

- Theranostics
- Energy harvesting
- Printed pharmaceuticals

Printed functionality on flexible substrates

- Flexible electronics
- Sensors, indicators
- Ink formulations

Colloids and dispersions

- Colloidal stability
- Dispersion technology
- Rheology

Nanoporous structures

- Hierarchical materials
- Self-assembled structures
- Thin films

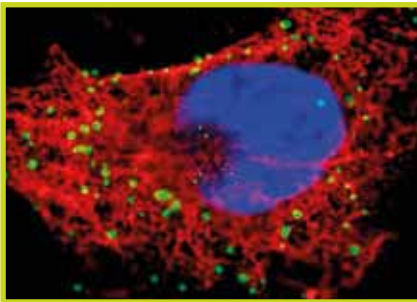
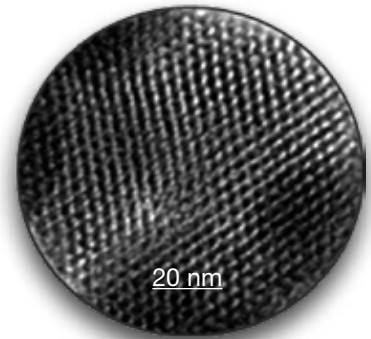
We design innovative materials:

- Synthesis of structurally advanced (nano)materials
- Novel integrated, hierarchical and hybrid composites
- Modified powders, fibers and particles with specific properties
- Nanoporous and self-assembled structures
- Pre- and post-functionalization, core-shell design
- Surface engineering and patterning

Advanced nanostructured materials and **controlled surfaces**

Controlled synthesis and tuning of

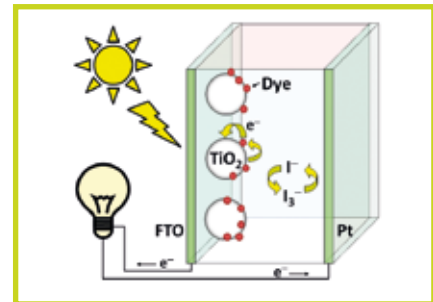
- Particle and pore size (nm-mm)
- Morphology and chemical composition (core-shell designs)
- Particle stability in suspension
- Surface functionalization



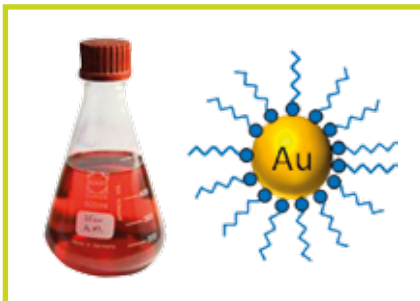
**Theranostic materials,
targeting and bioimaging**



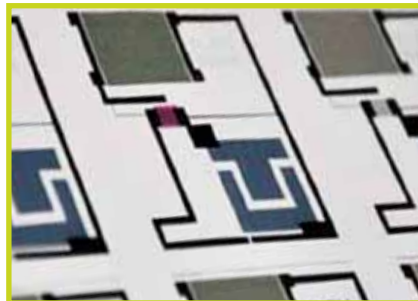
Separation and filtration



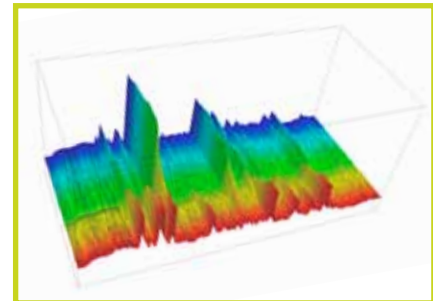
Light harvesting



Ink formulations



Printed devices

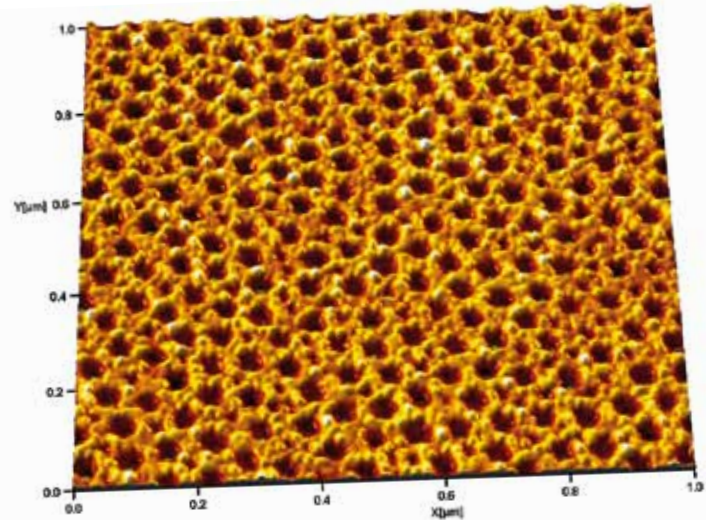
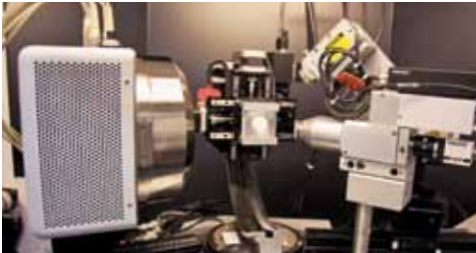


Functional cement filler materials

Instruments, methods and modeling

We can provide

- Relevant information on material structure, morphology and properties
- Unique possibilities for bulk and surface characterization, both of raw materials, their processing and performance



An AFM topograph of the solar cell surface.

The main techniques include

- *Calorimetry – chemical reaction energies enthalpies (microcalorimeter, DSC)*
- *Chromatography – separation and quantification of components on the molecular level (GC, HPLC, SEC)*
- *Diffractometry – nanostructures, crystalline materials (XRD), thin-film analysis (XRR), pore and particle sizes (SAXS)*
- *Goniometry – contact angle, dynamic wetting (surfaces/liquids)*
- *Light scattering – particle size distributions*
- *Microbalance – interactions and kinetics of adsorption/desorption (QCM-D)*
- *Microscopy – AFM, EFM, LMF, SPM, torsional harmonic AFM, optical, SEM/EDS, TEM*
- *Osmometry – osmotic pressure of solutes*
- *Rheometry – fluid deformation dynamics (viscosity, elastic and viscous particle interactions)*
- *Sorptometry – surface area, porosity*
- *Spectrometry – atomic level structures, functional groups (MS, FTIR, UV-VIS, TOF-SIMS, XPS)*
- *Tensiometry – surface tension (liquids)*
- *Thermogravimetry – thermal reactivity, chemical composition (TGA)*
- *Electrokinetic properties –particle charge*

Links to other sources: www.top-analytica.com, www.abo.fi/expertkatalog

We perform high-quality research in materials, colloid and surface chemistry. We utilize nature's phenomenology in fundamental and applied research for developing functional materials for various applications.

We educate experts in physical chemistry – one of the most universal sciences. We have 90-years of tradition within surface and colloid science, research and education.

We provide characterization services by our unique and broad range of tools.



Contact us

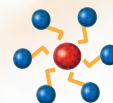
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