

15.02.2024

Successful R&I in Europe 2024 - 11th European Networking Event

Gas-Phase Synthesis of highly sophisticated nanomaterials: Products for Future Energy Applications

Tim Hülser, Division Particle Process Technology and Characterization

Institut für Umwelt & Energie, Technik & Analytik e. V. (IUTA)

Institute for Environment & Energy, Technology & Analytics

An-Institut der

UNIVERSITÄT
DUISBURG
ESSEN

Aerosole & Particle Technology

- Nano particles & Fine Dust
- Synthesis methods
- Work safety
- Environmental impact

Air purification & Gas process Technology

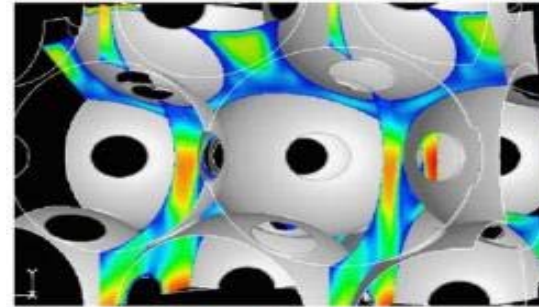
- Sorption processes
- Filtration processes
- CFD-simulations
- numerical particle distribution

Ressources & Toxines

- Identification
- Separation
- Process analysis
- Process development

Analytics & Measurement Technology

- Field measurements
- Trace element analytics
- Effect analytics
- Measurement device development



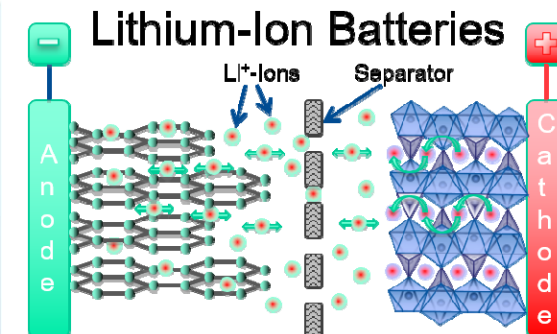
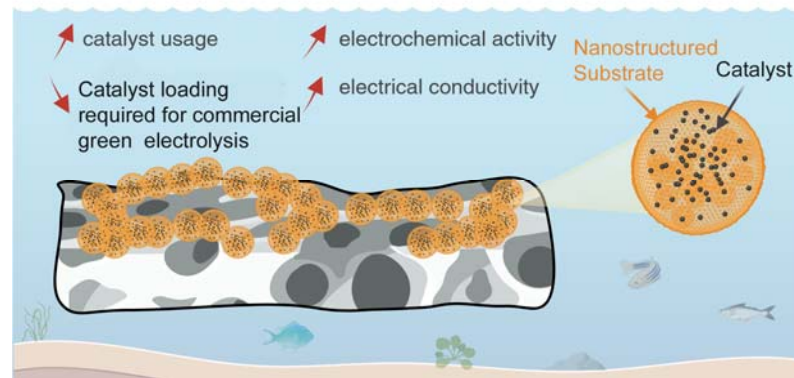


- Nanoparticles available on the kg/h scale

1. Energy Technologies

- Catalysis (electrolyzers, fuel cells)
- Energy Storage (batteries)
- Energy Harvesting (thermoelectrics)
- Energy conversion (photovoltaics)

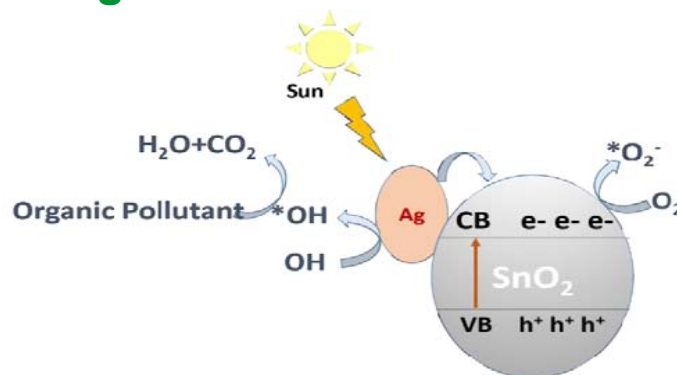
Electrolysis



2. Environmental Technologies

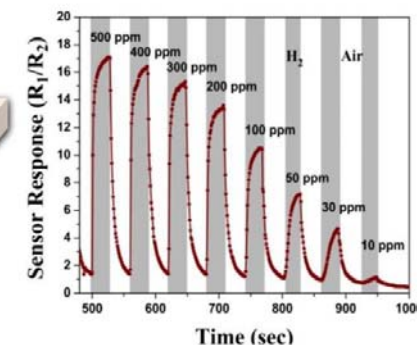
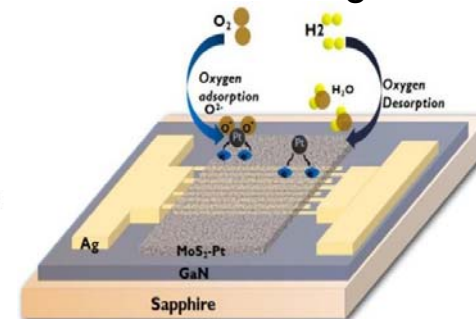
- Filtration
- Sorbents
- Photocatalysis
- Chemical Reactions
- Sensors

Photocatalysis



Source: Shittu et al. in: Biointerface Research in Applied 13 (2023) 165 ff.

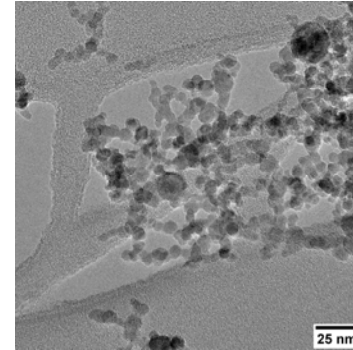
Gas Sensing



Source: Chu et al. in: Vid. Proc. Adv. Mater., Volume 1, Article ID 200828 (2020)

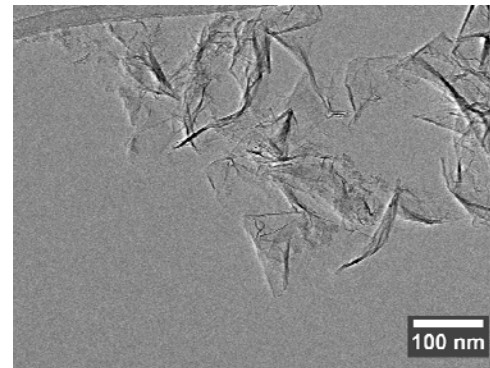
Oxides

- Perovskites (LSM,....)
- Titania (doped/undoped, special phases)
- Specific Iron oxides (Spinelles)
- Semiconducting oxides

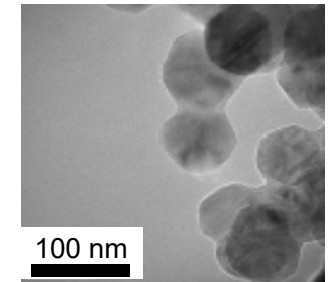


Non- Oxides & Composites

- Si, doped and un-doped
- Si @ C, SiC
- Si doped SiO₂ (Si Quantum dots)
- Graphene
- FeSi₂
- Core Shell Systems (Fe@Fe₂O₃)



Graphene



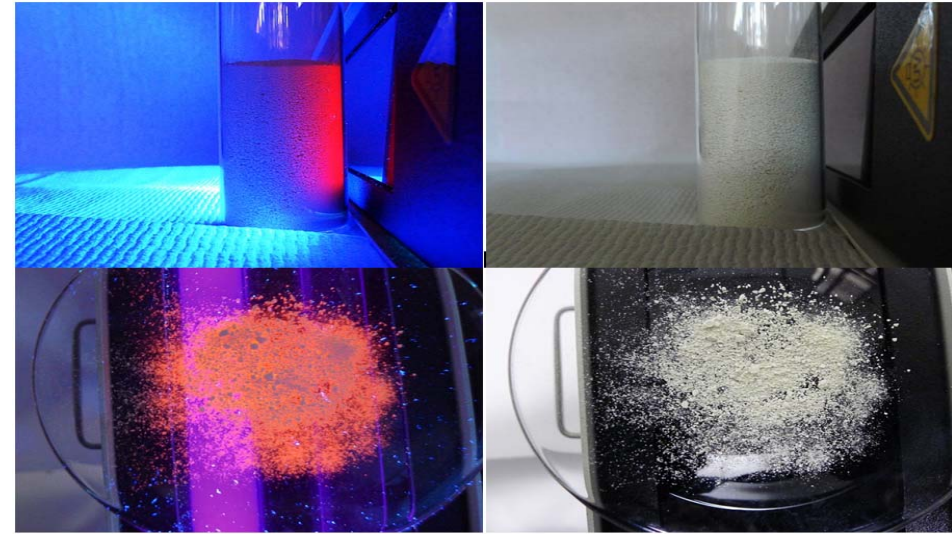
Si- Nanoparticles

Analytics: Powder

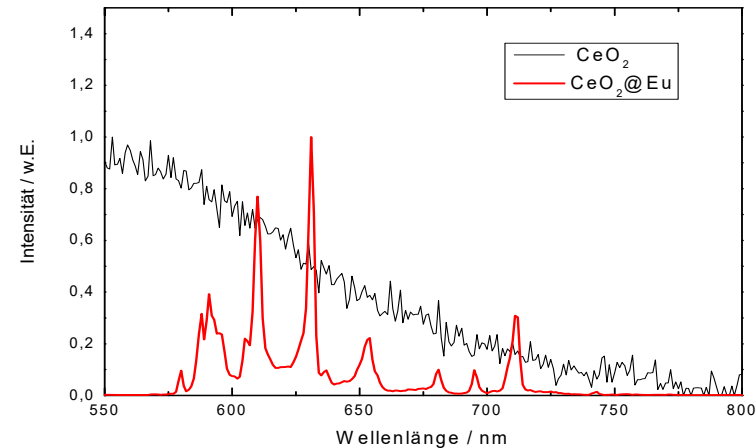
- REM with integrated RAMAN
- BET
- FTIR
- Impedance measurement
- Luminescence Analysis

Processing: Particle transfer to liquid

- wet electrostatic precipitator
- milling
- sonication



Anregung der Probe DENANA-19 mittels einer UV-Leuchte (365-nm) 1



IUTA contributes

- Cover research and new standards for functional nanoparticles
- material supplier with the focus to perform experiments on the pilot plant scale
- provide sufficient material amounts for industrial testing and development.
- All energy related topics including the use of nanomaterials are an option to participate.

New partners searched:

- Research partners (industry and university) in the field of application of functional nanomaterials synthesis,
- Application partners (companies), that are interested to bring our developments to the market

IUTA, experiences:

- NanoFASE, 4 years, 2015-2019 (H2020)
- BIORIMA, 4 years, 2017-2021 (H2020)
- FutureNanoNeeds, 4 years, 2014-2017 (FP7)
- AirMonTech, 4 years, 2010-2014
- Nanodevice , 4 years, 2008-2012
- NanoImpactNet, 4 years, 2008-2012
- EnerGEO, 4 years, 2009-2013
- NETZ- Nanomaterials for Energy Applications, 4 years, 2009-2013

Contact us at: huelser@iuta.de, www.iuta.de