

06.03.2025 and 07.03.2025

Successful R&I in Europe 2025 - 12th European Networking Event

Pilot-Plant Plasma Processes: From Alcohol to Graphene

Tim Hülser, Division Particle Process Technology and Characterization

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

Institute for Environment & Energy, Technology & Analytics

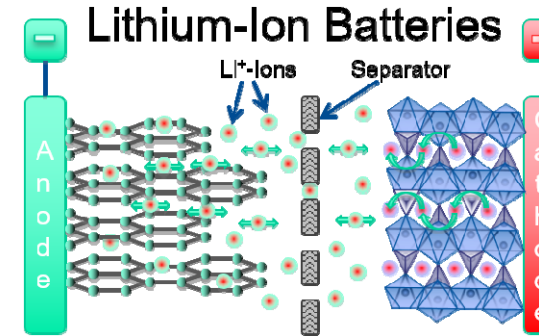
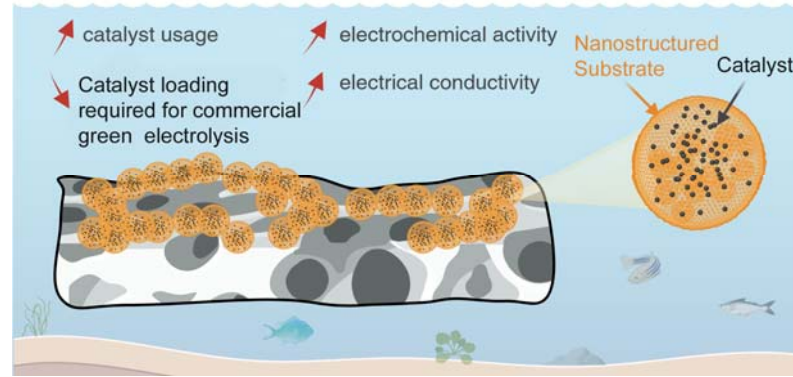
An-Institut der

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ESSEN

1. Energy Technologies

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

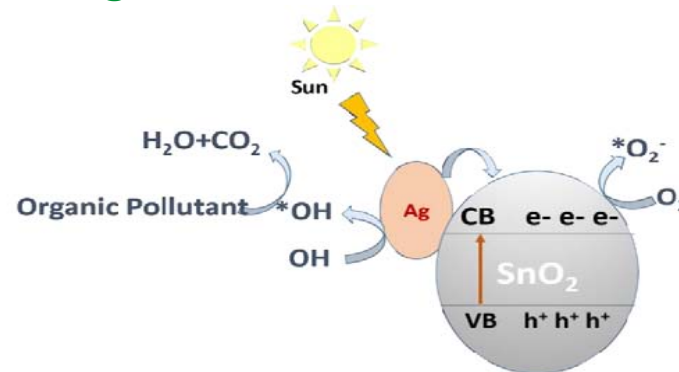
Electrolysis



2. Environmental Technologies

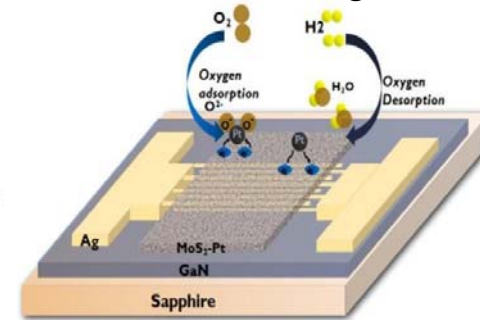
- Filtration
- Sorbents
- Photocatalysis
- Chemical Reactions
- Sensors

Photocatalysis

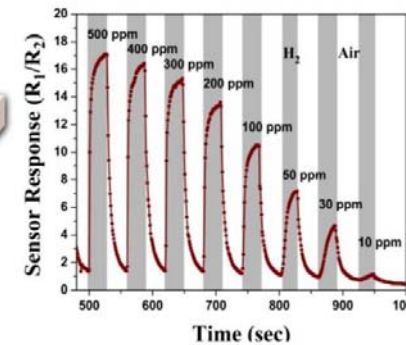


Source: Shittu et al. in: Biointerface Research in Applied 13 (2023) 165 ff.

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

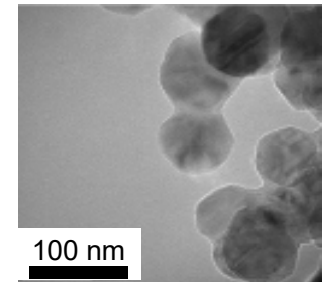


Non- Oxides & Composites

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

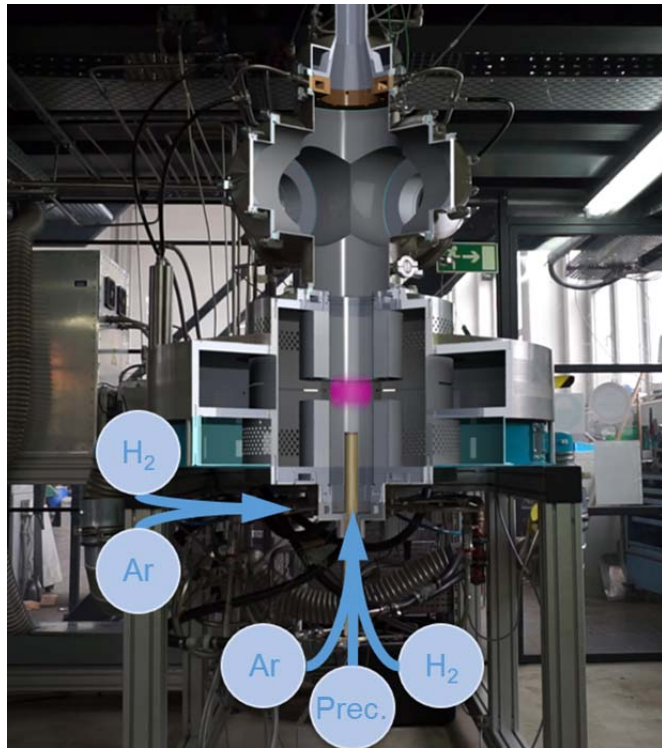
Analytics: Powder

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



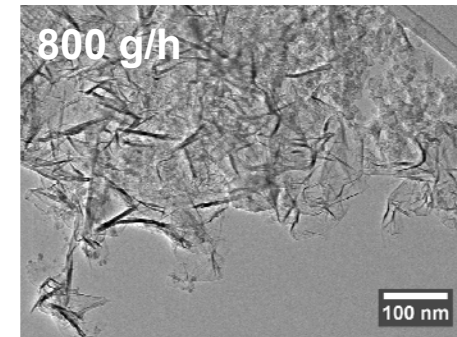
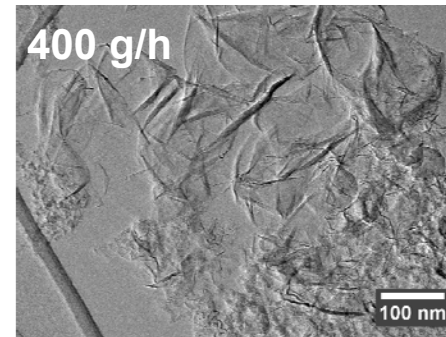
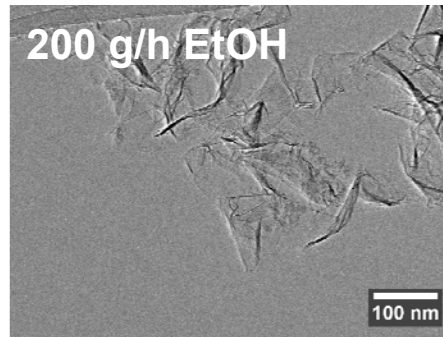
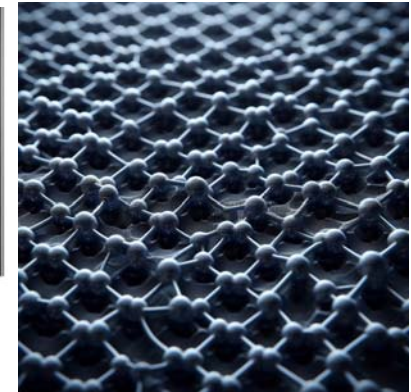
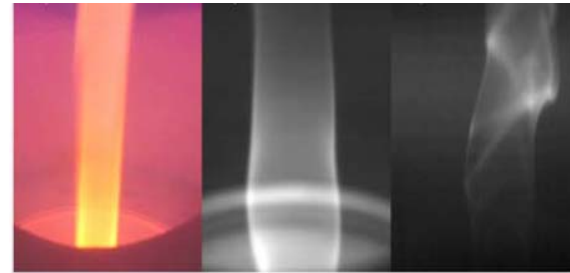
Si- Nanoparticles

From Alcohol to Graphene



Microwave supported plasma reactor

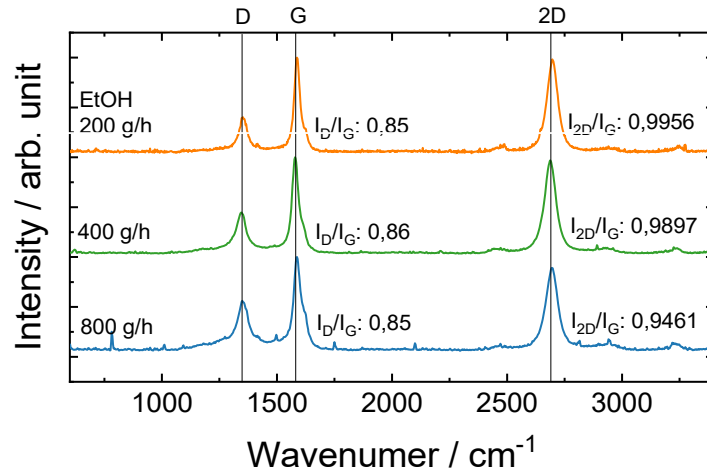
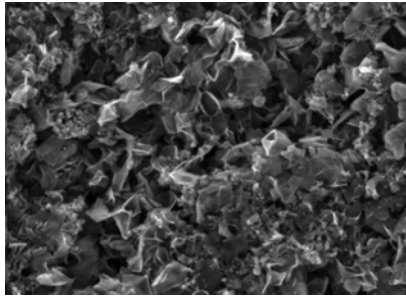
C_2H_6O
(Ethanol)



TEM proof that at production rates of 200 g/h soot structures are not visible. At production rates of 400 g/h and 800 g/h the presence of a few soot-like structures is shown by the TEM images.

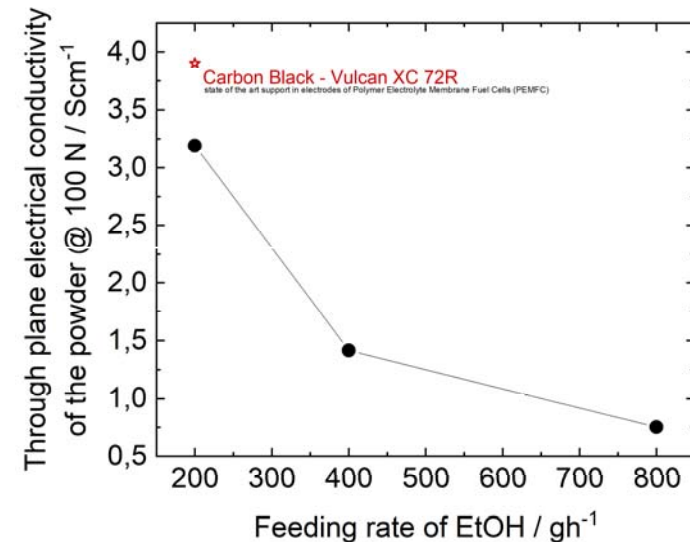
REM- RAMAN measurements

- Proof existence of Graphene
- Randomly orientated folded flakes



Conductivity measurement

- Pellet preparation
- Increasing conductivity with decreasing carbon particle amount
- Vulcan XC 72R with 3.9 S/cm is the state of the art for PEMFC



Special thanks to: Frederik Kunze (IUTA) for Graphene works

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