

Material Innovations for Hyconomy

Materials & Analytics for the hydrogen infrastructure, hydrogen safety and high temperature hydrogen processes

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(Accredited) Material Analysis:
failure, corrosion, embrittlement,
suitability, characterization



Safety: Sensing



Mobility / Transport:
Tanks, Barrier Coatings

HYDROGEN TECHNOLOGIES

@Fraunhofer ISC



Industry
Applications: Turbines,
Heating, Processing



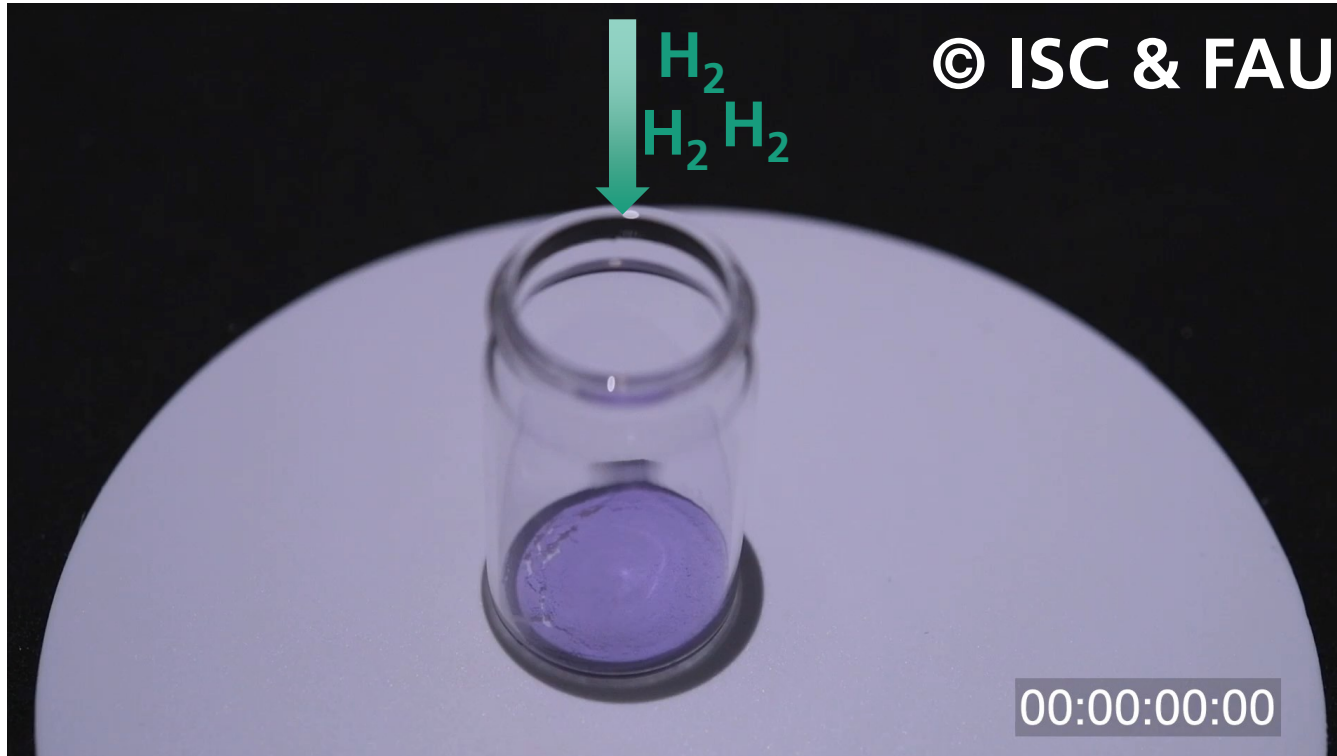
Systems: Catalysts, Seals



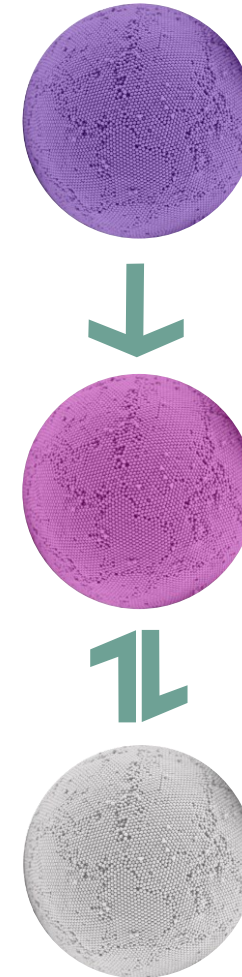
Energy Sector
Power Economy: Anti Soiling,
Batteries

Particle-based hydrogen detection at Fraunhofer ISC

For a safe hydrogen economy



Watch video on website



Recording of
 H_2 exposure *ex post*

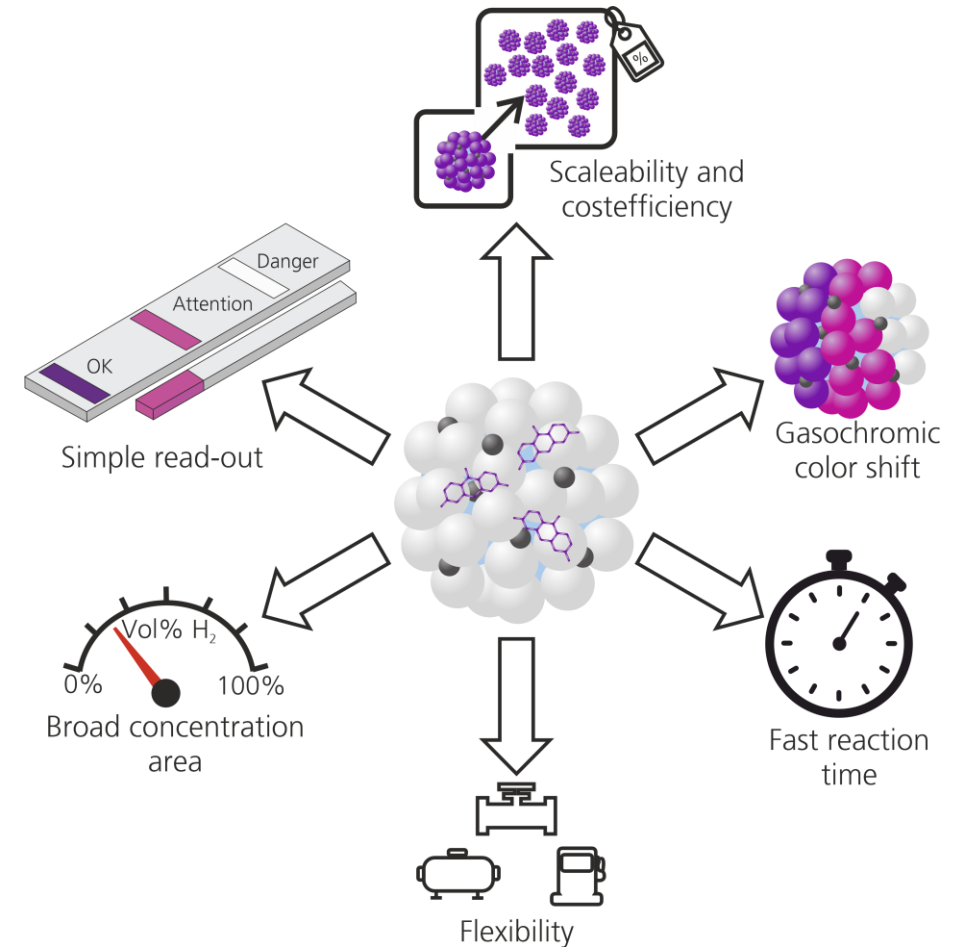
Real-time H_2
monitoring



Particle-based hydrogen detection at Fraunhofer ISC

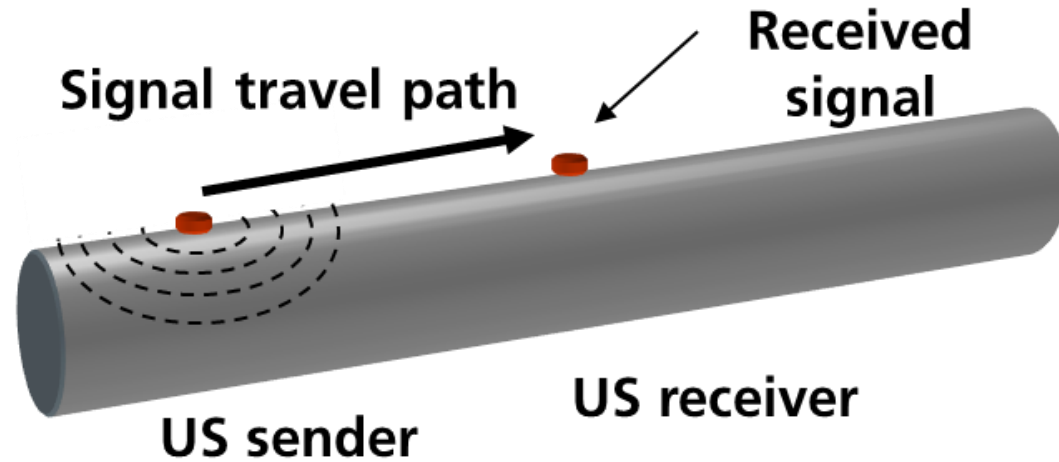
Outstanding benefits

- Naked-eye detection
- Color-change in ms to s time range
- Real-time monitoring and irreversible recording
- Usable as additive in different applications possible
- Broad concentration area
- Read-out without trained specialist personnel
- Scalable synthesis route and cost-efficient material
- Intrinsically safe in explosive atmosphere
- Adjustable design to monitor different target gases



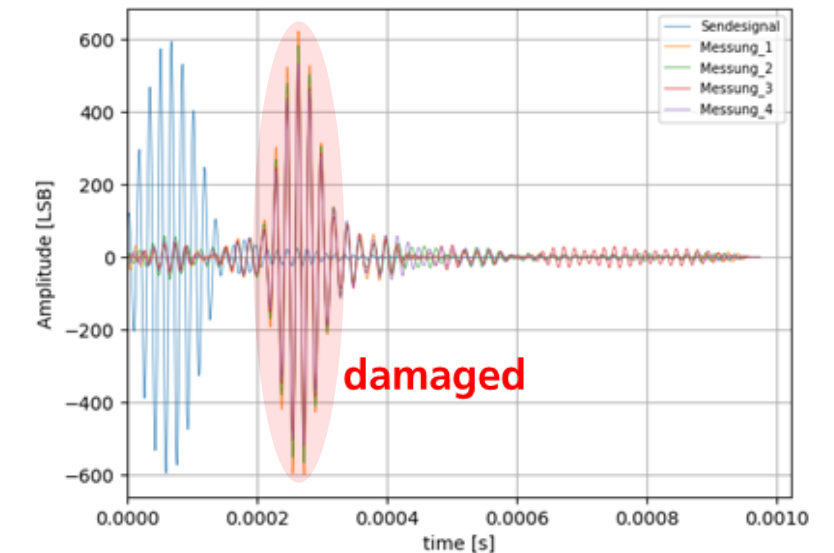
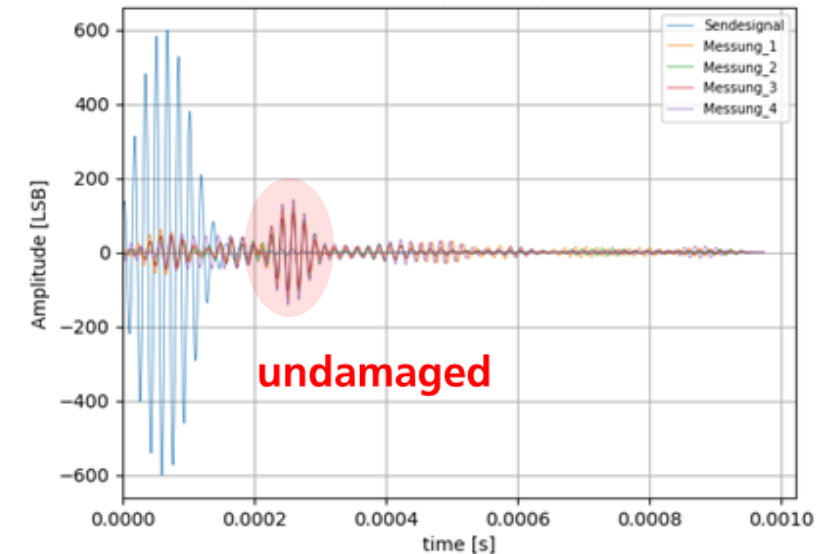
Structural health monitoring by ultrasonic surface acoustic waves

For a safe hydrogen economy



Comparative measurement of damaged and undamaged glass fiber reinforced tube (cutted flange).

- PVDF- polymer receiver @ 60 kHz
- distance between sender and receiver: 30 cm

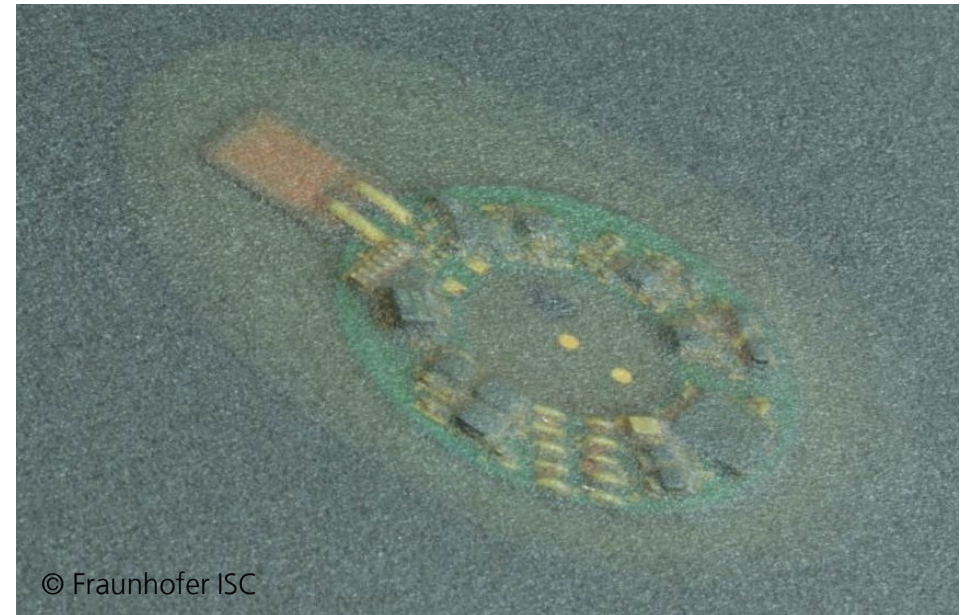


Structural health monitoring by ultrasonic surface acoustic waves

Outstanding benefits

Acoustic signature analysis with Lamb waves

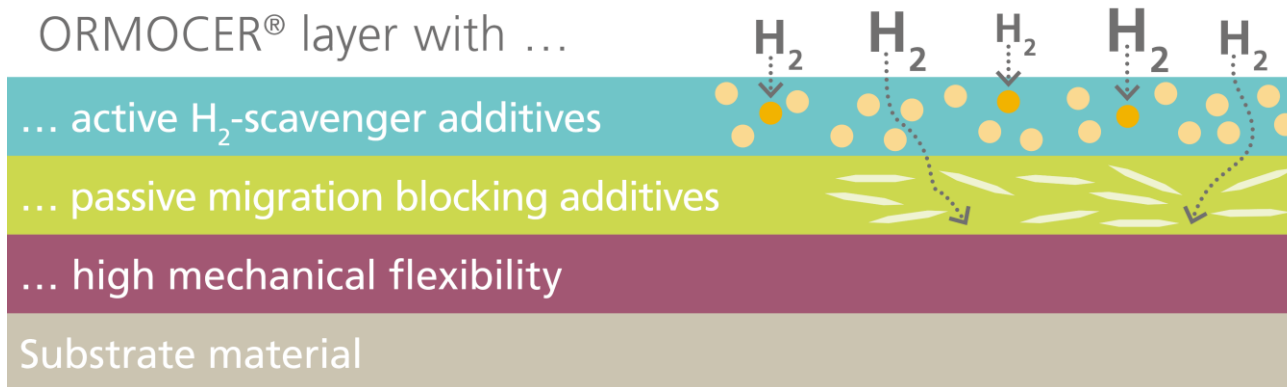
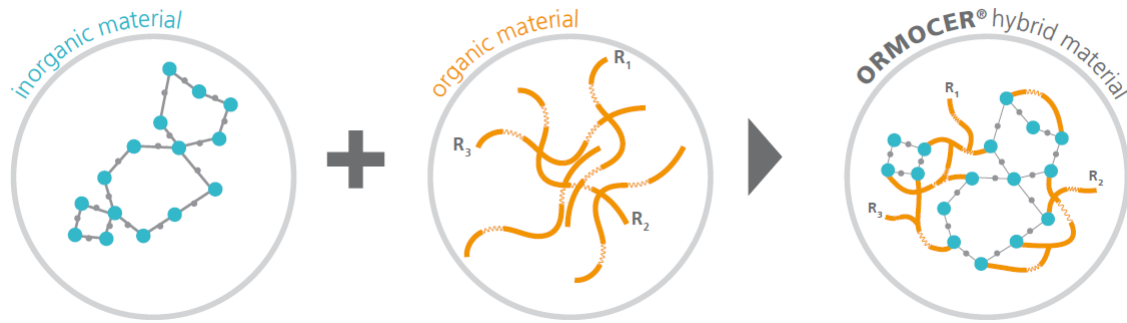
- Frequency range 60 – 250 kHz
- Long range ultrasonic wave transmission up to 1 m
- Using flexible piezoceramic (thin plate) or polymer based PVDF – transducers, applicable on metal or fiber reinforced tubes or tanks with small radius (10 mm up to 500 mm)
- Detection of cracks (~mm), delamination, degradation of bondings by additional wave packages or change in amplitude



Novel barrier coatings towards migration of H_2 and O_2

For a safe hydrogen infrastructure

ORMOCER® – an Effective Inorganic-Organic-Hybrid Material for Coatings



Novel barrier coatings towards migration of H₂ and O₂

Outstanding benefits

Enhanced barrier properties and prolonged diffusion pathways for hydrogen storage tank and pipe materials

- Combination with different inorganic, organic and hybrid coatings
- High flexibility with respect to mechanical properties
- Implementation of various additives
- Chemically and mechanically resistant
- High H₂ and O₂ barrier properties



Thank you for your attention!



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