We are looking into it: Cutting-edge Sensing Technologies for a Smarter Industry

Dr. Stefan Zerobin

2023-11-23, International Mobility Days 2023, Austrian Federal Economic Chamber, Vienna, Austria

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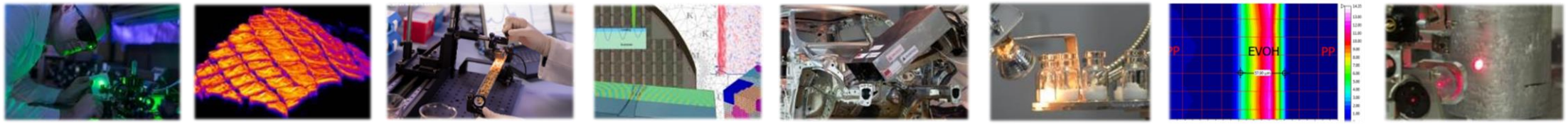
RESEARCH CENTER NON DESTRUCTIVE TESTING

Member of UAR INNOVATION NETWORK



With Smart Industry to Climate Neutrality

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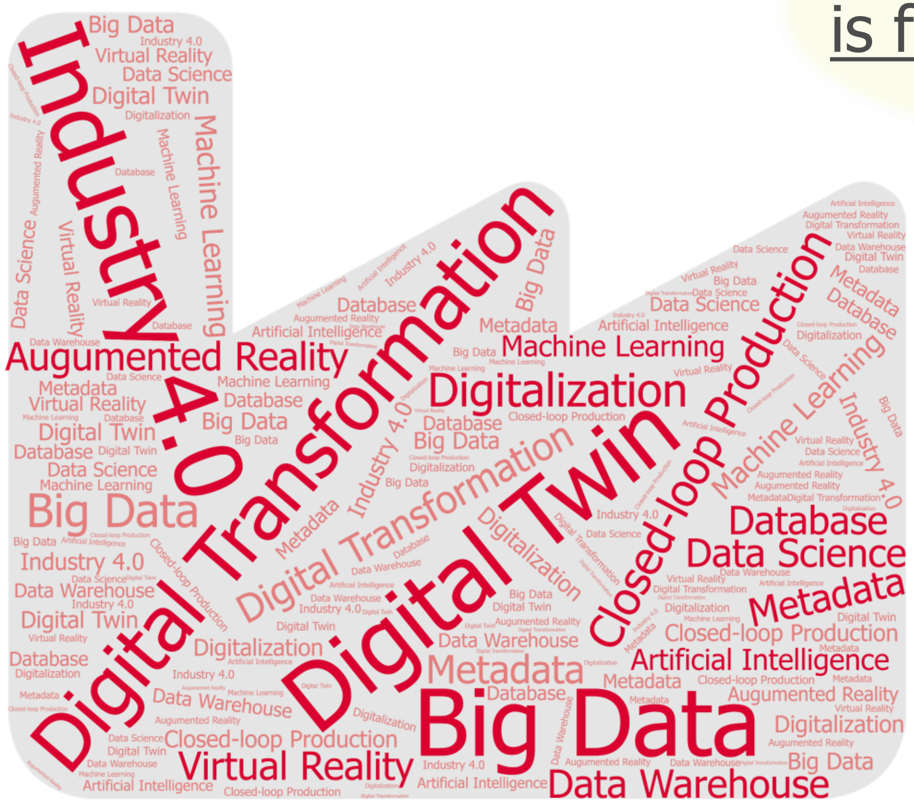
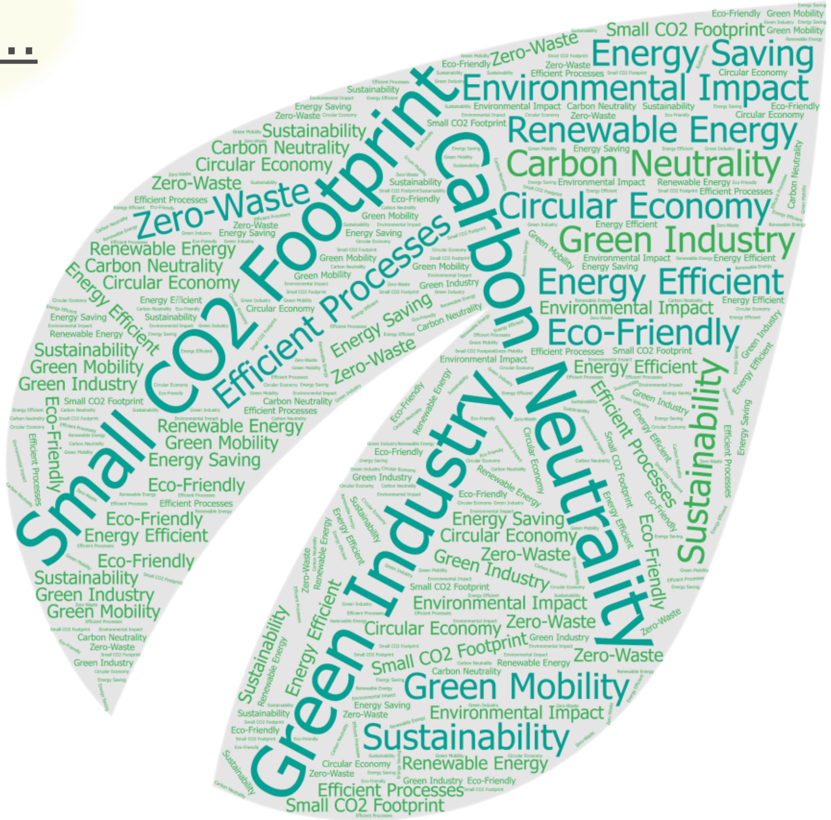
Metrology
is fundamental…





…to gain data

… to understand and optimize processes

How RECENDT supports your Industry

REsearch **CE**nter for **N**on-**D**estructive **T**esting

Science Park @ Johannes Kepler University
Linz, Austria

- Nonprofit, nonacademic research and technology organization
- Founded in 2009
- ~40 researchers
- Funded research
  (national, H2020, Horizon, ITN, …)
- Contract research

Member of UAR INNOVATION NETWORK

6 Research Groups:

• Infrared & Raman Spectroscopy • Optical Coherence Tomography • Terahertz Technology	**Optics**
• Laser-Ultrasound • Photoacoustics • Physical & Computational Acoustics	**Acoustics**

How RECENDT supports your Industry

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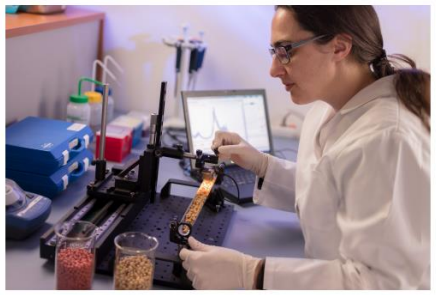
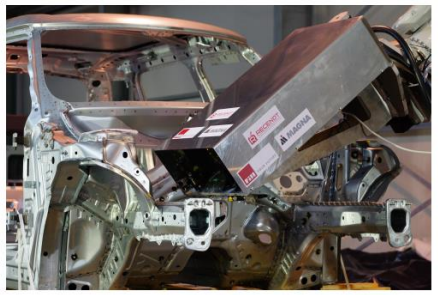
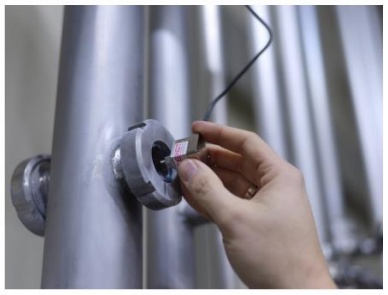
Material Characterization

Quality Inspection





Process Analytics



Custom-specific **contactless** & **non-destructive** sensing solutions in any phase of your needs…

- Proof-Of-Concept Studies
- R&D Consulting
- Sensing System Development
- Prototyping
- System Integration
- Measurement Service

Examples of Specific Solutions for the (Automotive) Industry

Quality Inspection of Welding Seams or Spots

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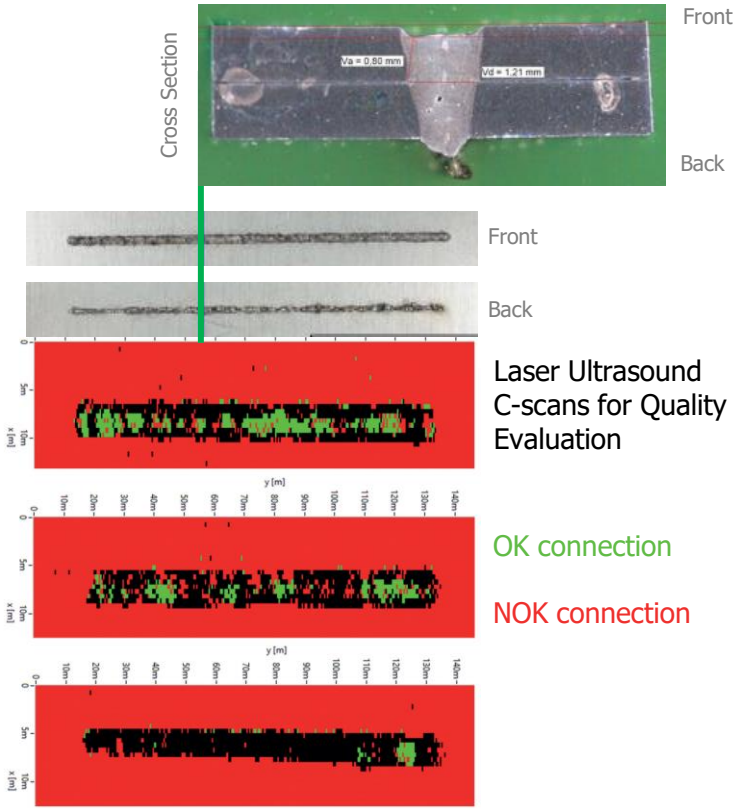
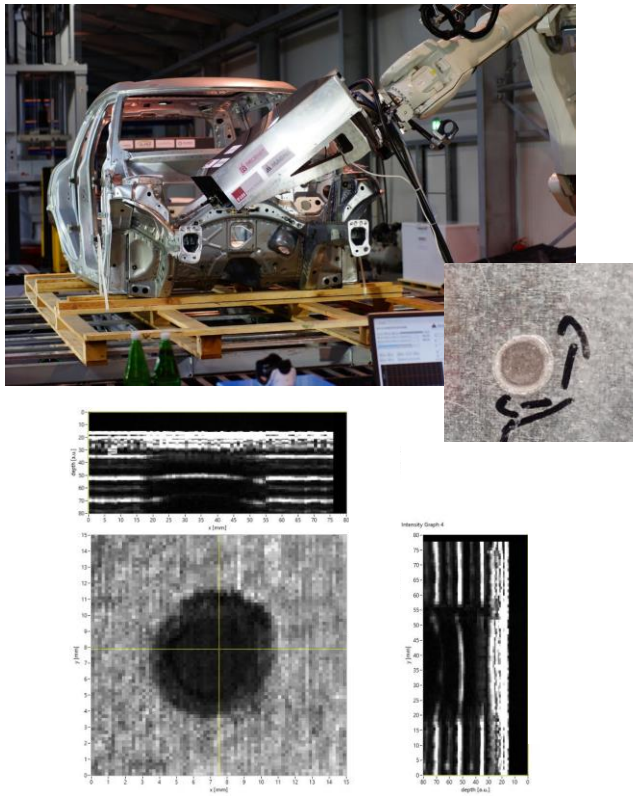
Defect detection of welded plates (steel, aluminum) for e.g. **BMW**



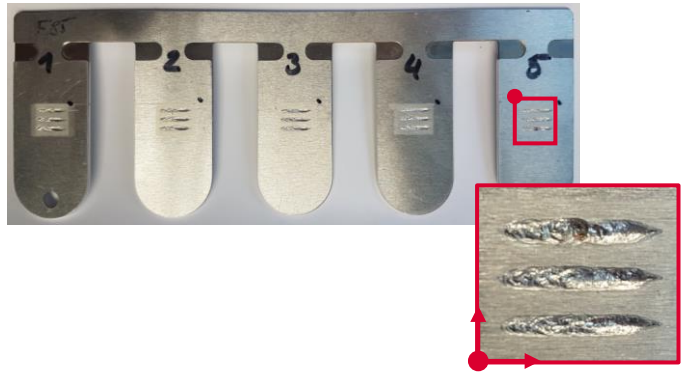
Source: „Laser-Ultraschall zur Prüfung von Laserstrahlschweißnähten", Huber et al., ZfP-Zeitung, July 2022

Defect detection of welding spots (steel, aluminum) for e.g. **Magna**



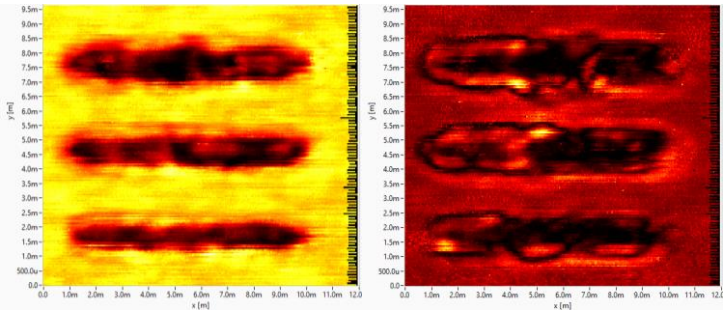
Laser Ultrasound B- and C-scans for Quality Evaluation

Defect detection of welded sheets (alu/copper/alu) for e.g. **PIA Automation**



Depth = 0.92mm

Depth = 1.38mm



Laser Ultrasound C-scans for Quality Evaluation

Quality Inspection of Thermally Treated Steel Parts

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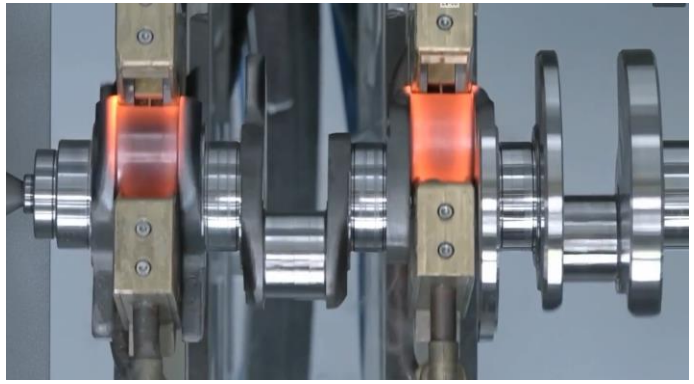
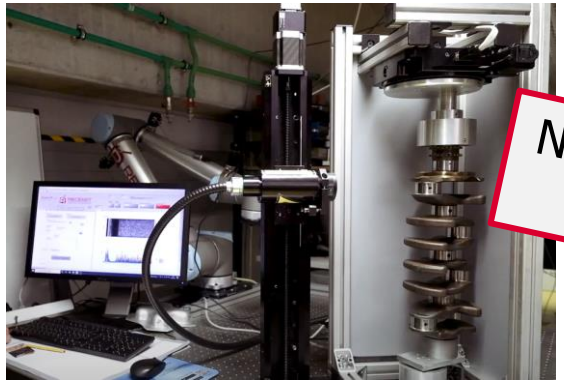
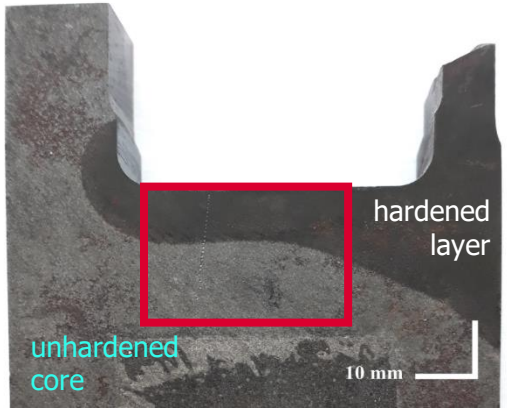
Non-destructive determination of **Hardness Penetration Depth** with Laser Ultrasound for e.g. **Alfing**



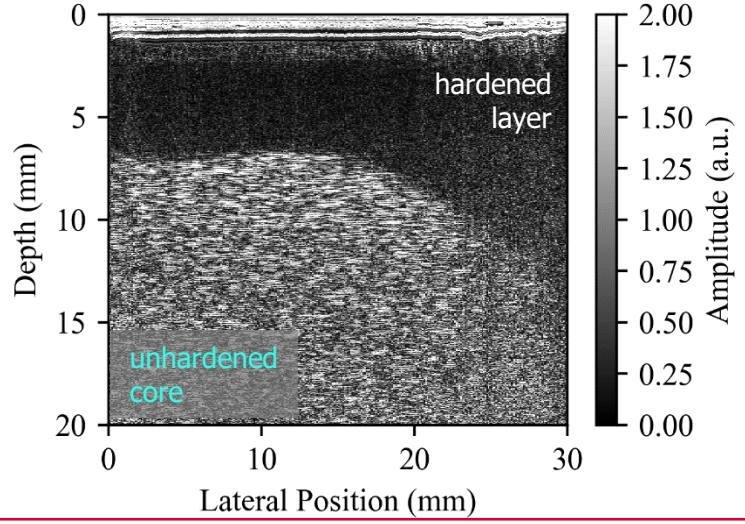


Non-destructive determination of grain structure!

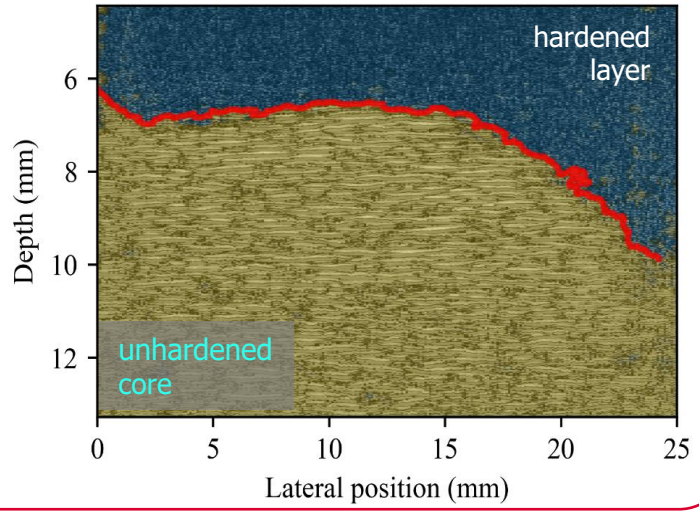
Photo of cut crankshaft



Laser Ultrasound B-scan



Pixel classification for depth evaluation



Source: Scherleitner et al., 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1178 012050
DOI 10.1088/1757-899X/1178/1/012050

Quality Inspection of Bondings

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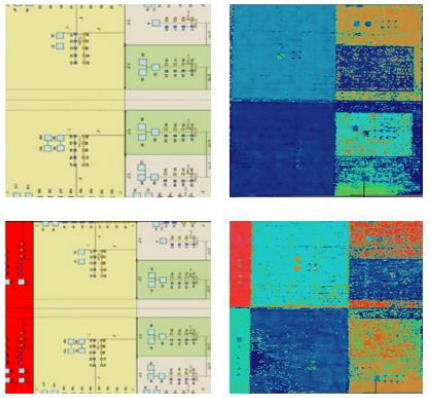
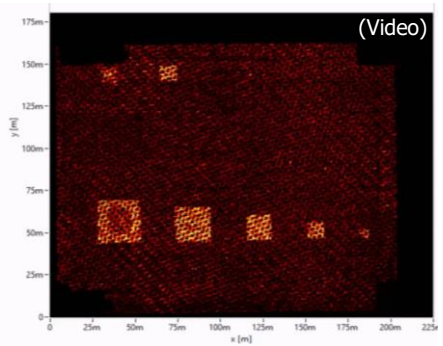
Detection of **delaminations and cracks in GFRP and CRFP** composites with Laser Ultrasound

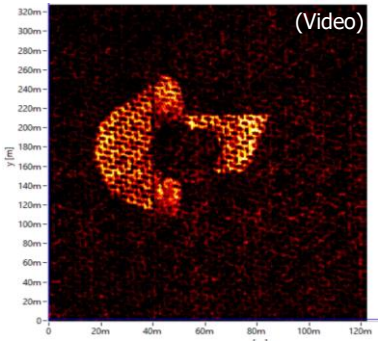


Scan speed: 8 m²/h
Min. flaw: Ø: 6 mm
Robot arm speed: 2.4 m/s
Source: H2020 – Cleansky project ACCURATe

Delaminations

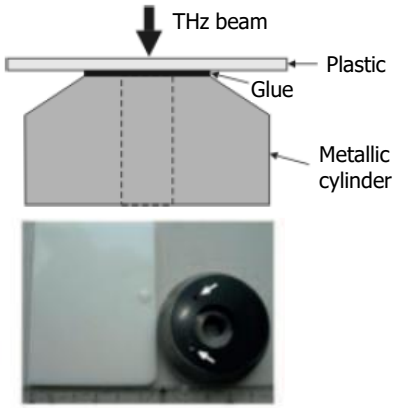


Impact damage

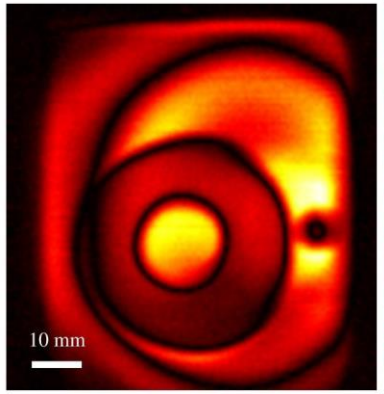


Making various flaws at different layers visible!

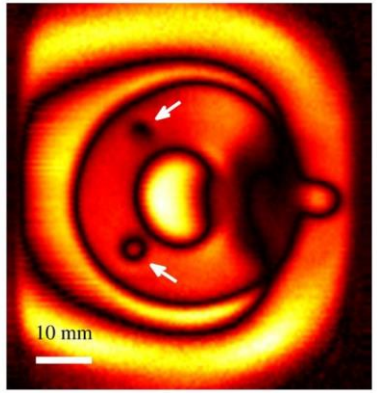
Detection of **defects in glued layers** with THz Imaging Technology



Depth 1



Depth 2



Quality Inspection of Coatings

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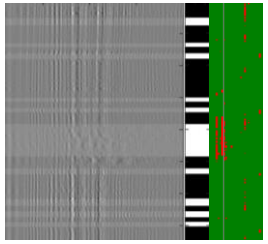
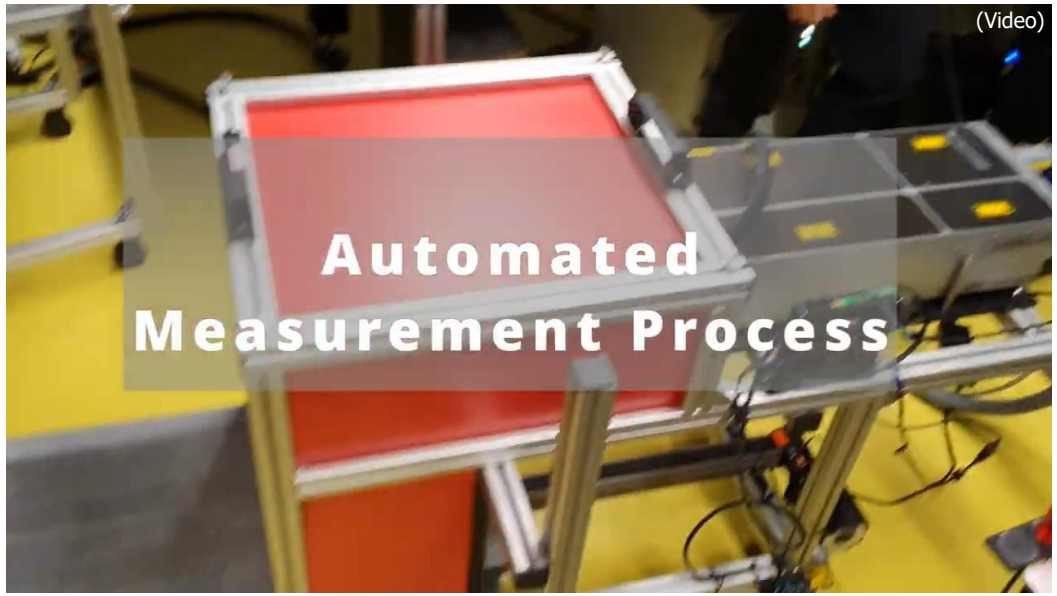
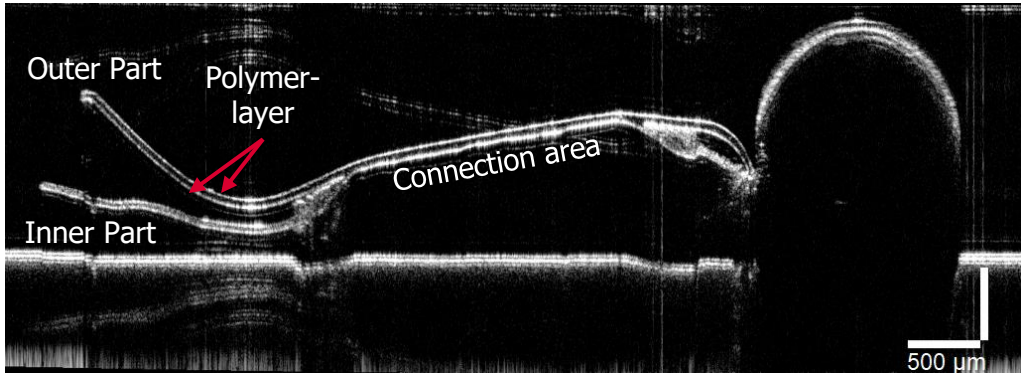
Detection of delamination of Al-layer on Fe-substrate with Laser Ultrasound for **Miba Automation Systems**

Automatic labeling of flaw positions by AI

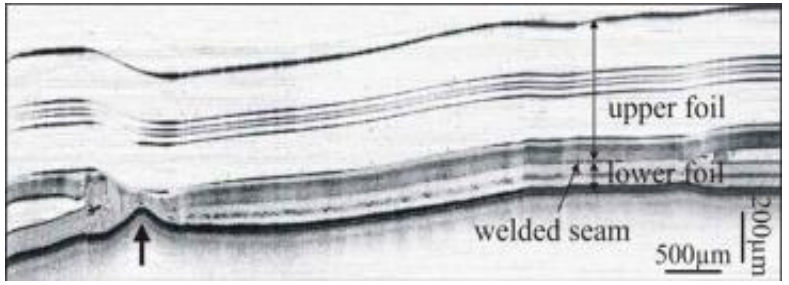




Determination of **coating thickness** of Polymer-layer on Al-substrate with Optical Coherence Tomography



Characterization of multi-layer films



*Source: Wiesauer et al., Optics Express **13**, 1015 (2005)*

In-Line Chemical Characterization

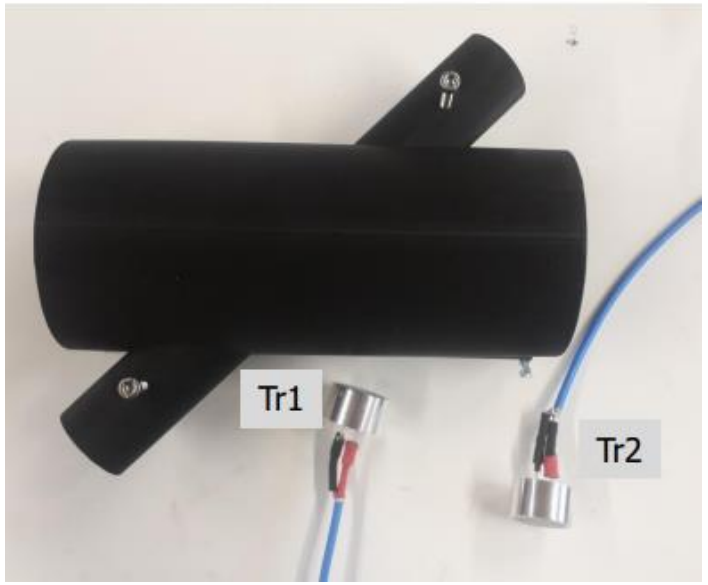
Current development of a new low-cost and robust sensor prototype for **H2 detection** in air

Development within national granted project SMASH2 (FFG Bridge) with project partner **Plastic Omnium**

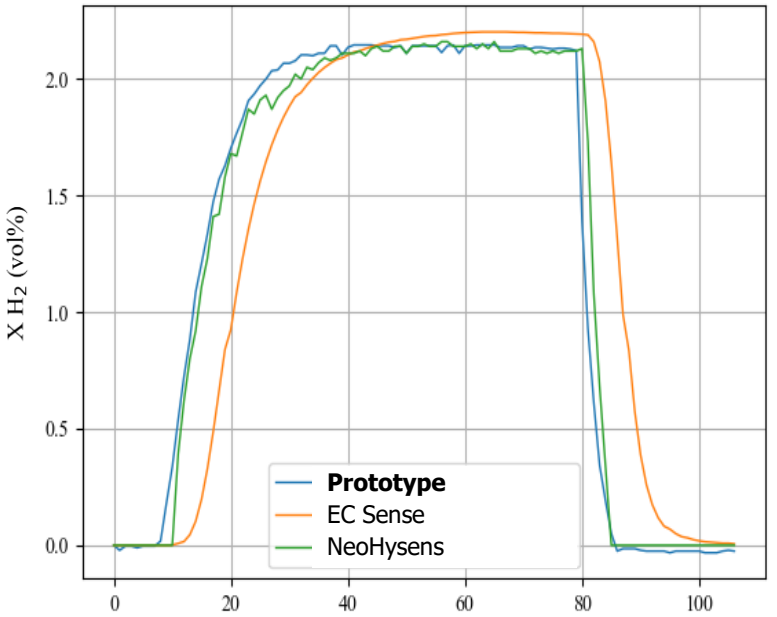
Realtime measurement of

- pressure
- temperature
- humidity (→ IR)
- flow rate (→ Ultrasound)
- H2 concentration (→ Ultrasound)

Prototype



Comparison to stock sensors



Gas from bottle: 2,02% H2 in synthetic air

We're looking into it!

„It is our mission
to gain insight into **materials**,
substances and **processes** in
novel and non-destructive ways."

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See you at booth 20!

- www.recendt.at
- A – 4040 Linz, Altenberger Straße 69, Science Park 2

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Linz / Austria, Science Park 2, JKU Campus © Josef König