FLAG–ERA JTC 2017 Project

CO_2-DETECT
Waveguide-Integrated Mid-Infrared Graphene Detectors for Optical Gas Sensor Systems

Frank Niklaus, KTH

KTH Royal Institute of Technology; Sweden

SenseAir AB, Sweden

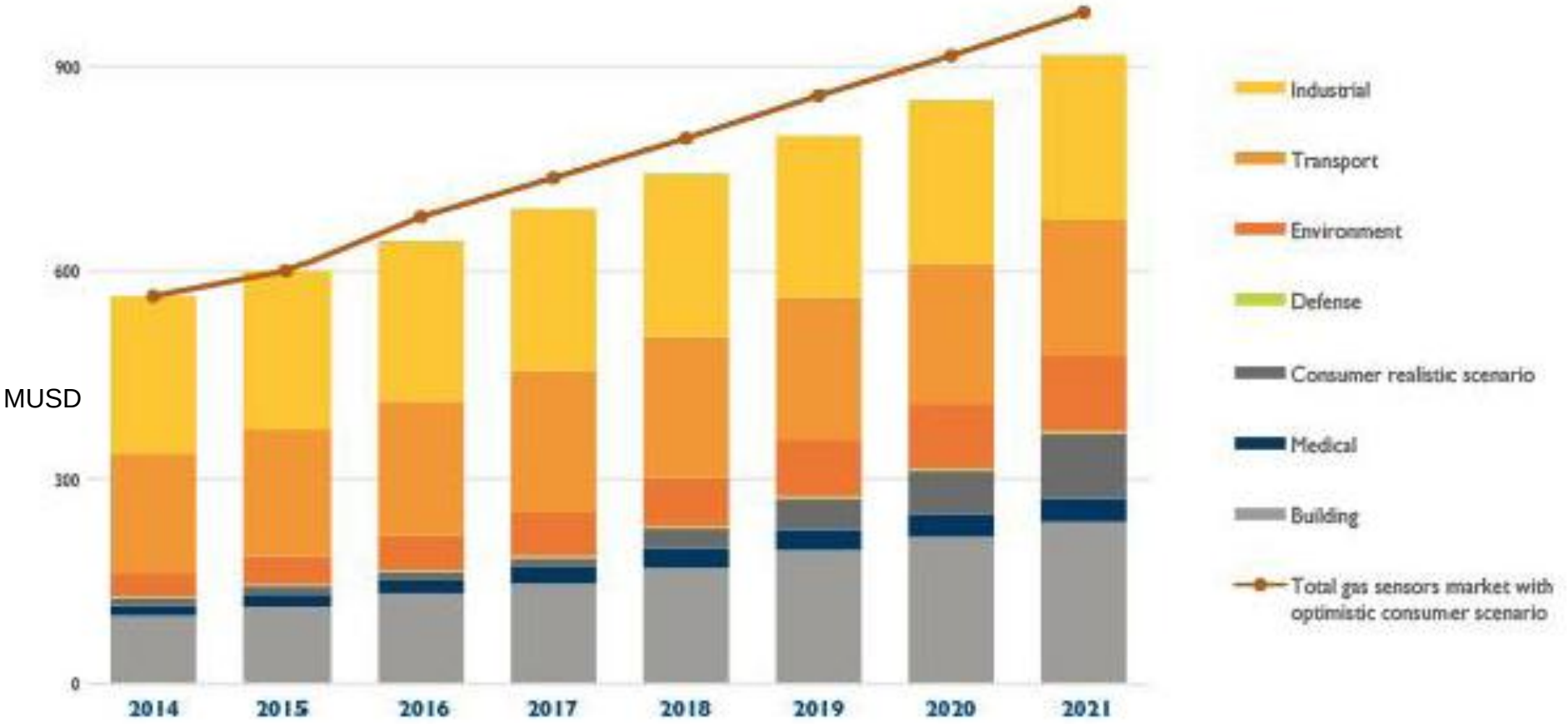
AMO GmbH

Catalan Institute of Nanoscience and Nanotechnology

Outline

- Application Background
- Project Overview
- Project Partners

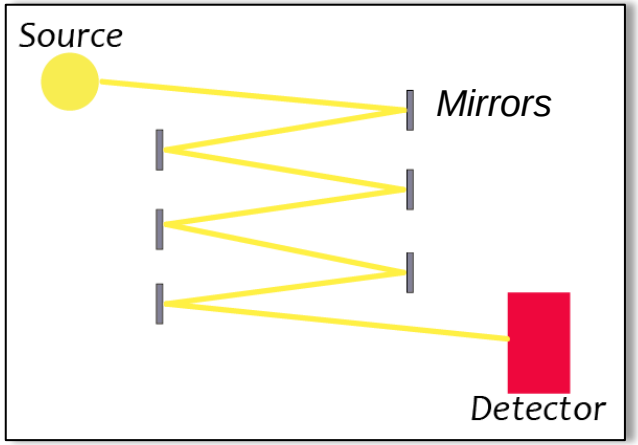
Gas Sensor Markets

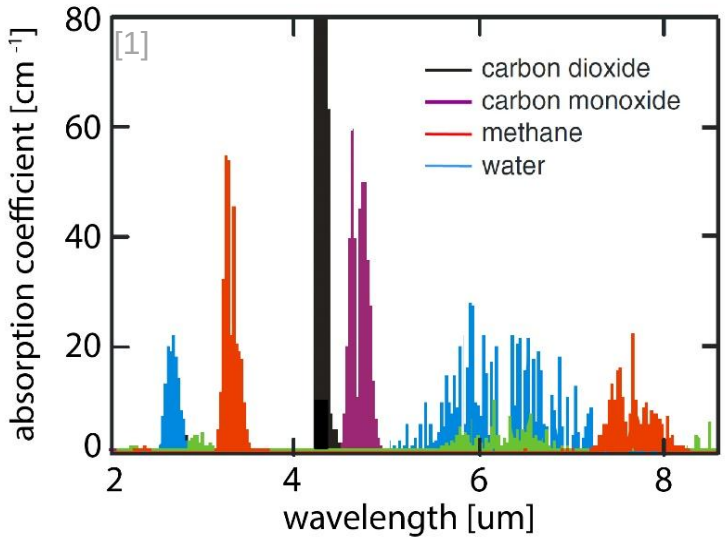


https://www.i-micronews.com/report/product/gas-sensor-technology-and-market.html.

Optical Gas Sensors

Nonedispersive Infrared optical gas sensing





Benefits of optical sensors

- High selectivity
- Long term stability

Drawbacks of current optical sensors

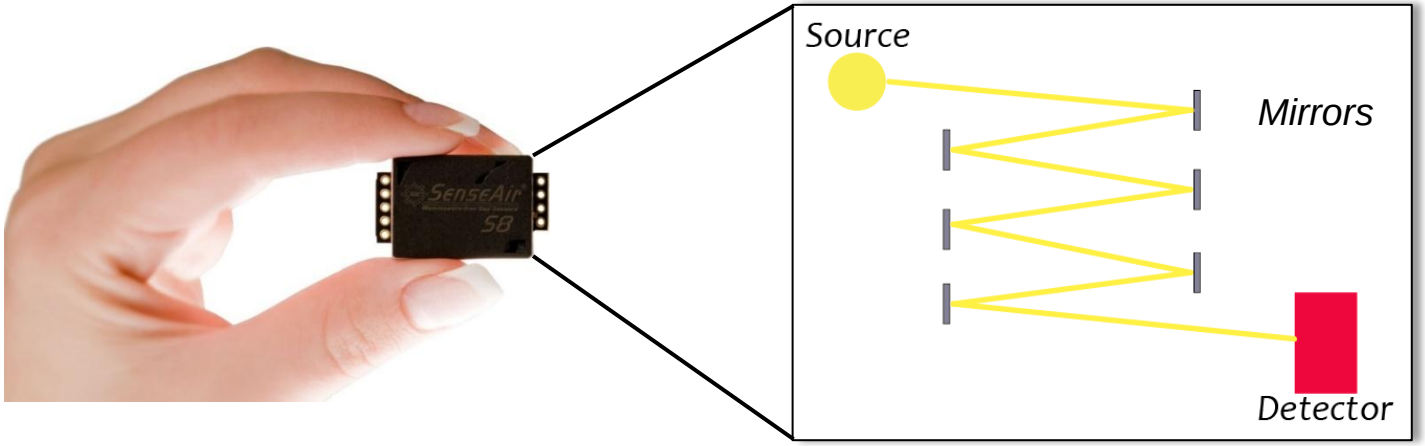
- High power use
- Large size
- Discrete components

[1] Hodgkinson, Jane, and Ralph P Tatam. “Optical Gas Sensing: A Review.” *Measurement Science and Technology* 24, no. 1 (January 1, 2013): 12004.

Slide partly by Floria Ottonello Briano

Vision of personal gas sensors

Smallest currently commercially available optical CO_2 sensor



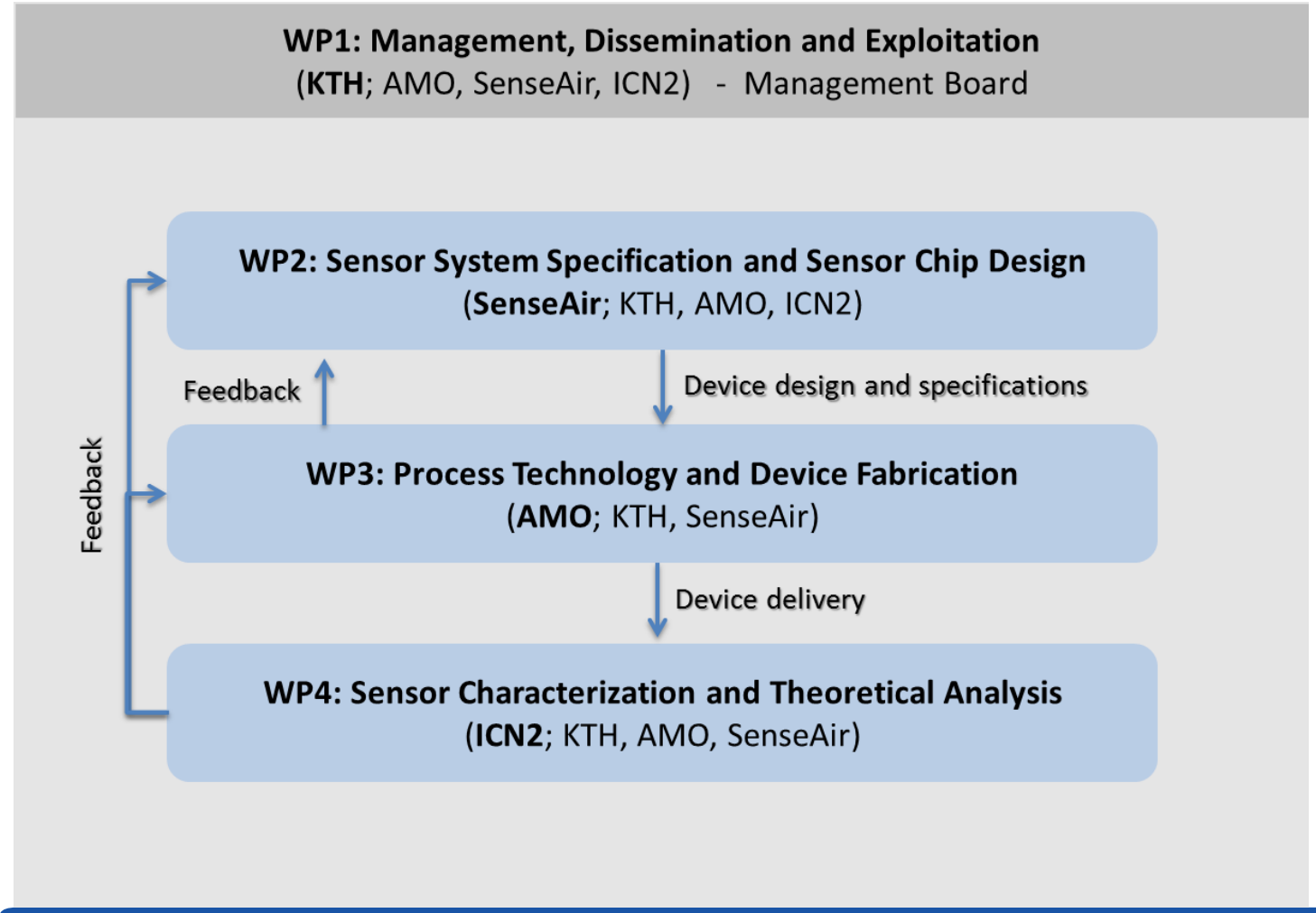
Vision of personal miniaturized multi-gas sensors

Miniaturized, low power gas sensors

Integration into small, portable devices

Senseair

Work Package Overview of CO_2-DETECT

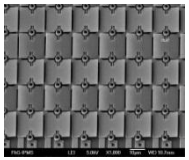


KTH Department of Micro and Nanosystems

Head: Prof. Göran Stemme

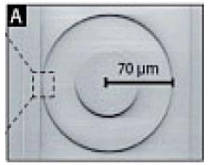
- Micro and Nanofabrication

  Prof. Frank Niklaus



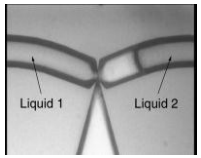
- Micro-Optic Sensors

  Ass. Prof. Hans Sohlström and Ass. Prof. Kristinn Gylfason



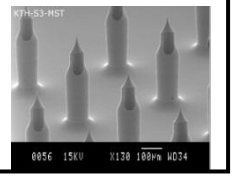
- Lab-on-Chip / Polymers

  Prof. Wouter van der Wijngaart



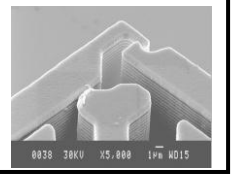
- Medical MEMS

  Ass. Prof. Niclas Roxhed



- RF and Microwave MEMS

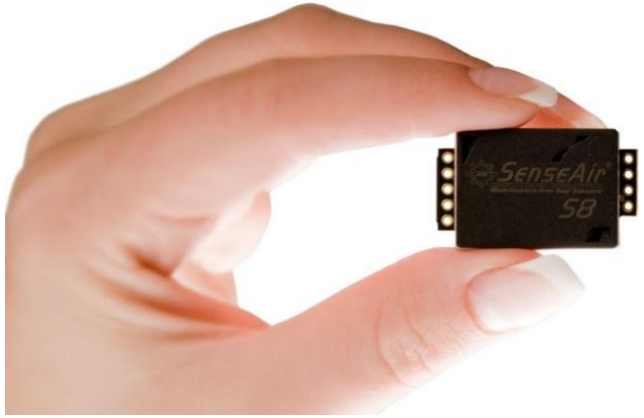
  Prof. Joachim Oberhammer



Senseair AB, Sweden

Senseair is a leading global provider of air and gas sensing technology (CO_2, alcohol etc.).

Our purpose it to make sense of air by providing the best possible measurement solutions, services and intelligence.



RWTH Aachen University & AMO GmbH

RWTH Aachen University

- Large European Technical Univ.
- 45.000 students
- Triangle:
  Germany / Belgium /Netherlands
- Chair of Electronic Devices (10)

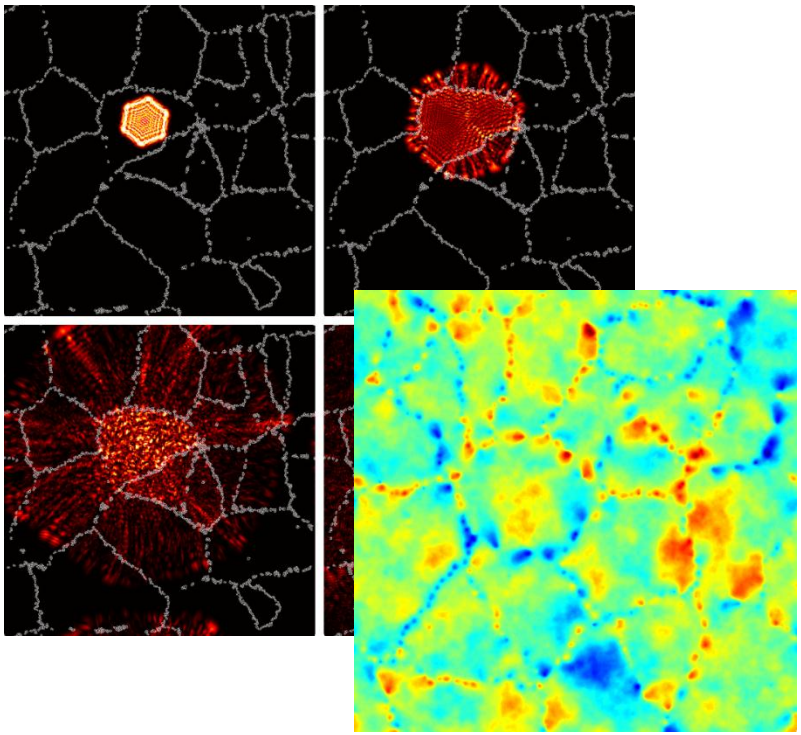
AMO GmbH

- High-Tech SME / Institute (non-profit)
- Research Foundry
- 400 m^2 clean room
- 40 staff members

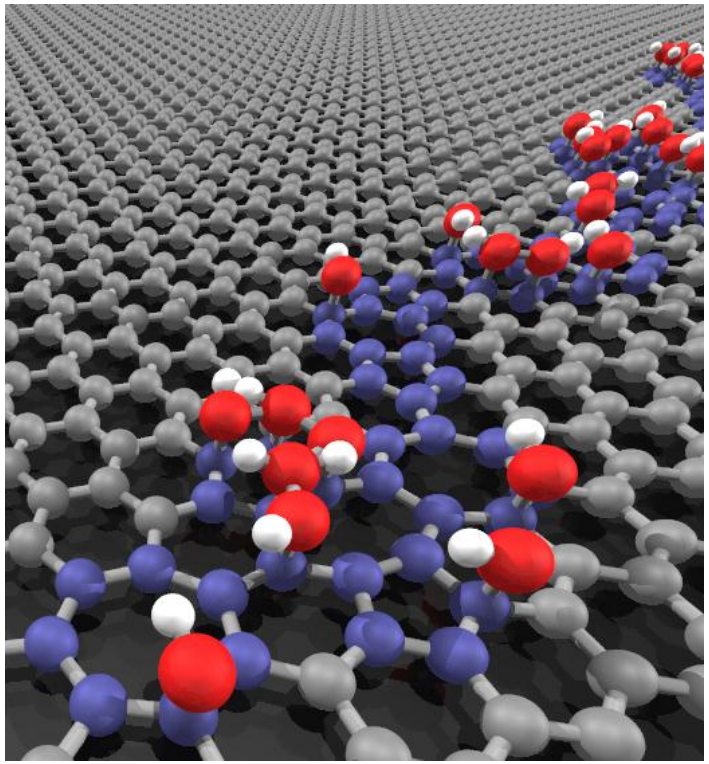
- Key technologies
  - Silicon Technology Base
  - Nanofabrication (NIL, E-Beam, IL)
  - New Materials Integration (high-k/metal gate, graphene, 2D)
  - Applications
    - Nanoelectronics
    - Nanophotonics
    - Integrated Sensors

Research at ICN2: Transport Simulations

Real-space quantum transport and molecular dynamics



Impact of gas adsorption



How will CO_2 adsorption impact the transport properties of the graphene layer?

Thank you for your attention …

Questions?