

# Chemical sensors based on III-nitride quantum dots as optical transducers (DOTSENSE) – FP7-ICT-STREP 224212

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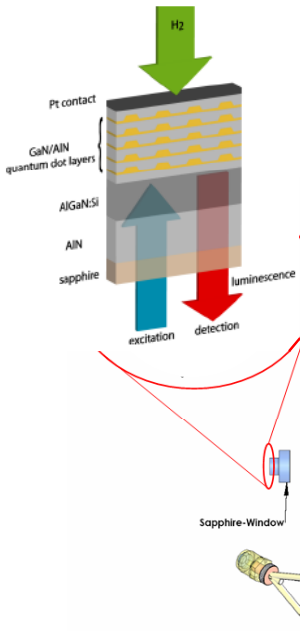
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## TARGET :

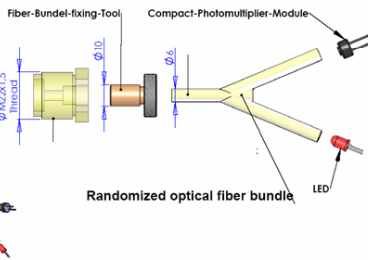
Development of nano-optical transducers based on (In)GaN quantum dots for chemical sensors operating in liquid and gaseous environment



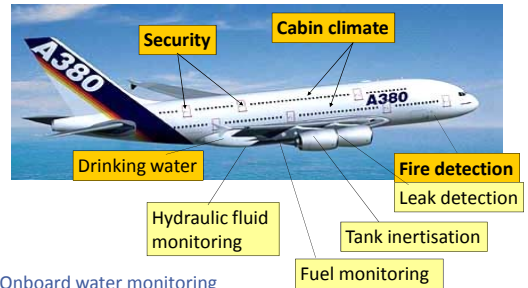
- Chemically resistive InGaN QD stack in AlN matrix
- Efficient photoluminescence at room temperature and above
- Reduction of necessary electrical feedthroughs
- Built-in separation of media

- Detection of pH and hydrogen in aerospace applications

**Sensing mechanism:**  
Detection of chemically-induced variations of the surface potential by measurement of changes in photoluminescence characteristics

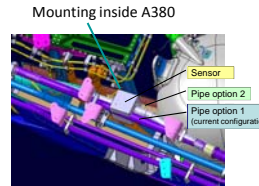


## DOTSENSE APPLICATIONS :



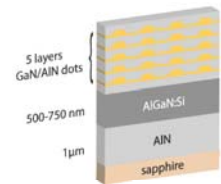
- Onboard water monitoring
- Hydraulic fluid monitoring
- Fuel- and hydraulic leak detection

### Multi-Parameter Hydraulic Fluid Sensor (Airbus specifications)

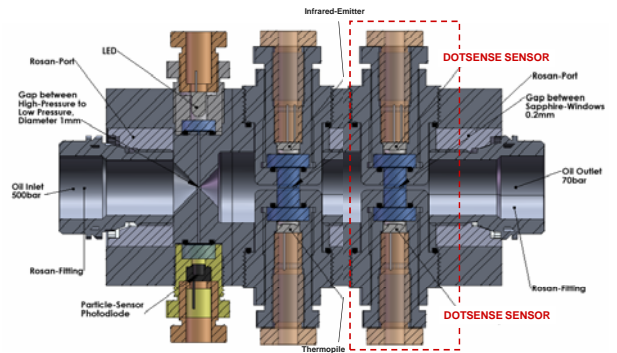
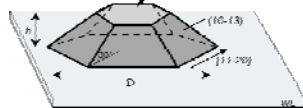
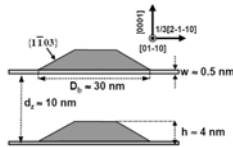
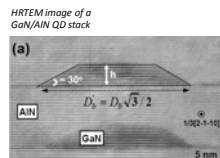
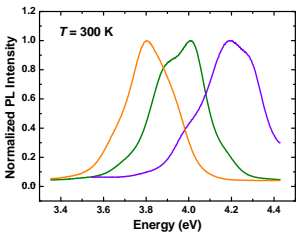


- Online measurement of:
- Water content
  - Total acidity number (TAN)
  - Chlorine content
  - Fluid conductivity
  - Particulate matter contamination close to hydraulics reservoir

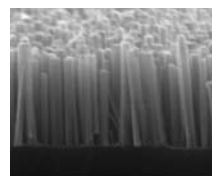
## QUANTUM DOT TRANSDUCERS :



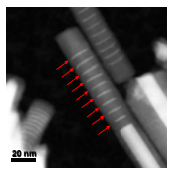
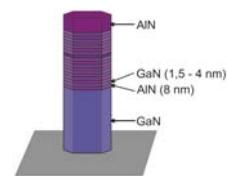
Growth by plasma-assisted MBE on AlN-on-sapphire templates



## ALTERNATIVE TRANSDUCERS : NANODISKS

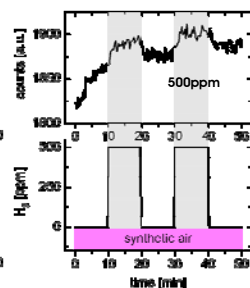
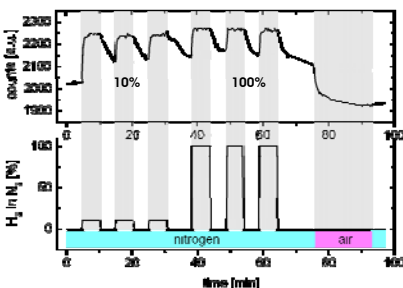


Growth by plasma-assisted MBE on Si(111) substrates



Z-contrast image bright areas: GaN Image: J. Arbiol, J.-R. Morante, University of Barcelona

- PL peak energy tuneable in the UV/visible range
- Efficient photoluminescence at room temperature and above
- Optical detection of hydrogen by changes in PL intensity of GaN/AlN quantum dots



- Growth of GaN / AlGaIn and GaN / AlN nanowires with embedded GaN quantum disks
- Emission energy can be controlled with
  - Al content in the barrier
  - Well thickness
- Intense emission
- Growth of nonpolar QWs on the sidewalls possible