# SINTEF Microsystems and Nanotechnology Laboratory (MiNaLab)

1. Scope

SINTEF has been involved in silicon sensor technology since the early 1970ties. In 2005 SINTEF opened the new Microsystems and Nanotechnology laboratory (MiNaLab) which is entirely dedicated to sensor technology. The research fields include MEMS, Piezo-Mems, Micro-Optics, Micro-Fluidics and Radiation Sensors. In addition MiNaLab do small and medium scale production mainly in the field of radiation sensors and photo detectors.

2 Facilities

The MiNaLab has a clean room floor of 800 $m^2$. The equipment include diffusion furnaces, photolithography aligners and coaters, different plasma tools for 3-dimensional processing and deposition of passivation layers, vacuum equipment for metal deposition and different wet etch equipment. Assuming a four mask layer process the production capacity is 10.000 wafers per year on one shift. However, most of the projects include more than four mask layers, and in addition several project include 3 dimensional processing. Thus the real production capacity is lower.

The MiNaLab is situated on the campus of Oslo University and the building is shared with the Oslo University physics department which have a separate clean room floor of 600 m2. This leads to cross fertilization, and especially give MiNaLab access to advanced material analysis tools.

3 Research and development fields

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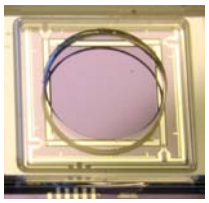
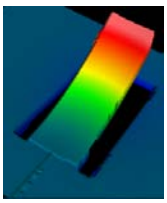
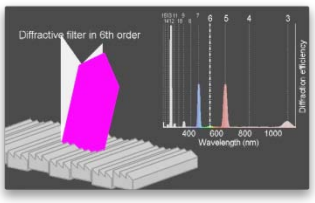


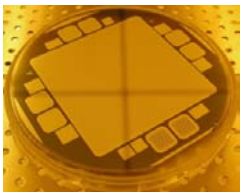
MEMS



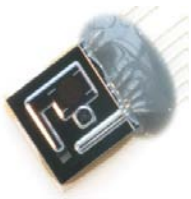
Piezo-MEMS




Micro-Optics



Radiation Sensors



Micro-Fluidics

The R&D field includes:

1) **MEMS** with development and small scale production of pressure transducers, accelerometers, ultra sound emitters and IR emitters

2) **Piezo MEMS** where piezoelectric materials like PZT are combined with MEMS technology to realize different transducers, actuators and micro-optic devices
3) **Micro-optics** are mainly diffractive optical elements realized by MEMS or Piezo MEMS processes
4) **Radiation detectors** with development and small and medium scale production of pixel detectors, single and double sided strip detectors, thick (2mm) and thin (10 µm) silicon detectors, silicon drift diodes (SDD), edge-on detectors, 3-dimensional detectors, photodiodes, and avalanche photodiodes (APD).
5) **Micro fluidics** where MEMS technologies are used to realize devices for medical analysis according to the lab-on-chip concept.

## 5 Applications

The main applications for MiNaLab R&D and products are:

1) **Medical applications** include micro fluidic elements for analysis of body liquid, pressure transducers for intracranial measurements, ultra sound transducers for intravascular imaging, and x-ray detectors for imaging applications and CT scanning
2) **Big Science applications** include pixel, strip detectors and 3-dimensional detectors for high energy physics (CERN, DESY, FNAL), and pixel detectors for synchrotrons and linear accelerators (SLAC)
3) **Material analysis applications** include different x-ray pixel and strip detectors, and PIN and SDD diodes
4) **Offshore Installation applications** include IR emitters and diffractive optical elements for gas analysis and surveillance, and high pressure transducers.
5) **Security applications** include detectors for low energy neutrons for applications in border control and baggage scanning to detect nuclear material and radioactive sources
6) **Space and aero space applications** include high precision altimeters, pressure transducers for European space crafts, photodiode chips for instrument loads on European satellites, and solar sensor chips for European communication and metrological satellites
7) **Defense applications** include photodiode chips and quadrants for application in European missiles and smart munitions, photodiode chips for laser warning, and avalanche photodiode chips for laser range finders