

Micro and Nanofabrication Clean Room

Techniques and equipment

MICROSYSTEMS LABORATORY

Available technologies

Wet etching:

- Bulk silicon micromachining (anisotropic wet etching)
- Surface silicon micromachining
- Metals wet etching: chrome, titanium, nickel, gold, tungsten, isotropic etching of silicon, aluminium nitride...
- Dielectrics wet etching: silicon oxide, hafnium oxide
- Glass micromachining by HF-based solutions

Lift-off process: Patterning of metal layers without wet etching.

Deposition of metals:

- Electroless: chemical deposition of metals (gold, nickel, copper)
- Electroplating: Electrochemical deposition of metals (gold, nickel, copper)

Porous silicon: formation of porous silicon layers by anodic etching

Wafers bonding:

- Anodic bonding: silicon-glass
- Fusion bonding: silicon-silicon
- Eutectic bonding: silicon-gold

Equipment



Wet etching and cleaning:

- 2 Chemical benches one for CMOS compatible wafers and another for wafers with contaminant metals
- 4 heated baths for anisotropic wet etching of silicon in alkaline solutions
- 4 multipurpose baths for metal etching and chemical depositions of metals
- 4 overflow rinse tanks for wafer cleaning and 2 nitrogen guns for wafer drying

Lift off:

- 3 ultrasonic baths
- Gas cabinet



Metals deposition:

- 2 baths for the chemical deposition of metals by Electroless
- Gas cabinet for electroplating processes
- Autolab to control the electrochemical processes



Critical point dryer of CO₂:

- Automegasandri 915 B@Tousimis



Porous silicon:

- Bath for the porosification of silicon
- Gas cabinet



Anodic bonding:

- Suss Microtech Sb6e

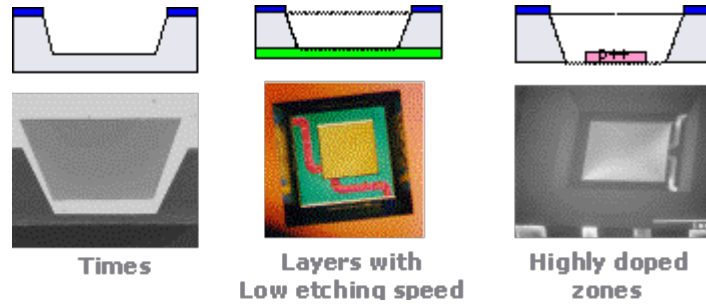


Test equipments:

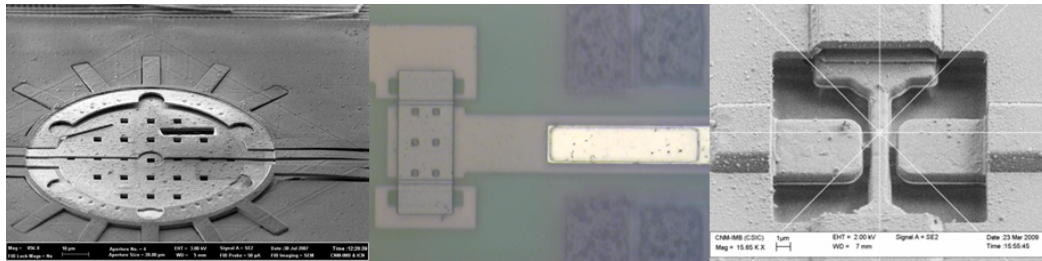
- Optical microscope
- Stereoscope microscope
- Optical profilometer

Available processes

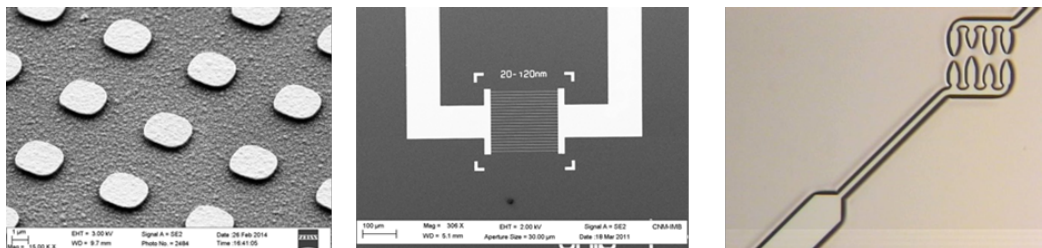
- *Anisotropic wet etching of Silicon* for bulk micromachining in alkaline solutions. KOH is used as etching solutions. SiO₂ and Si₃N₄ are used as mask layers during the etching. Three different etch-stop methods are available.



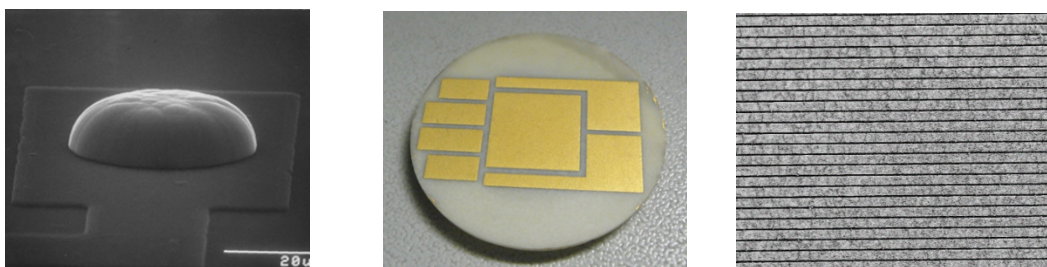
- *Surface micromachining of silicon.* Polysilicon is used as structural layer meanwhile the silicon oxide acts as sacrificial layer. HF-based solutions are used as etchants for the sacrificial layer etching. The process can be also done by HF-vapors. After the etching the samples can be dried by critical point dryer of CO₂ to avoid the sticking of the released structures.



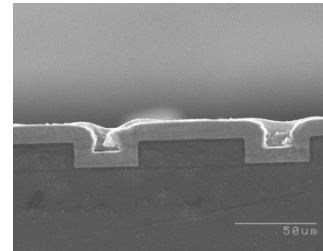
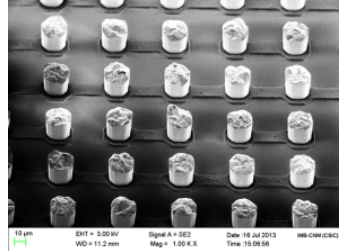
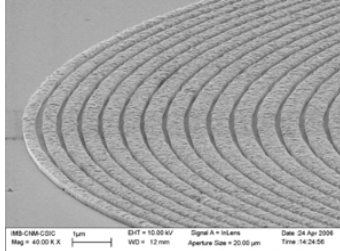
- *Lift-off process.* Patterning of metallic layers without chemical etching of the layer. The process can be performed for metals deposited by evaporation or even by sputtering.



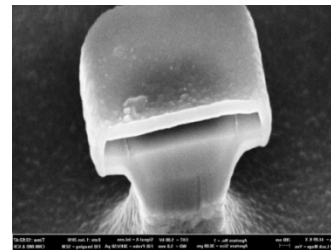
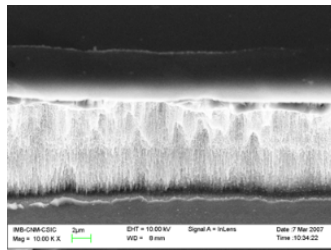
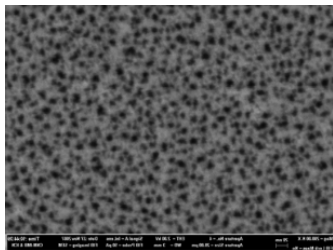
- *Chemical deposition of metals by Electroless.* Processes that create metal coatings on various materials surfaces by autocatalytic chemical reduction of metal cations in a liquid bath. Available metals are nickel, gold and copper.



□ *Electrodeposition of metals by electroplating.* Processes that create a metal coating on a solid substrate through the reduction of cations of that metal by means of a direct electric current. Available metals are nickel, gold, and copper.



□ *Porous silicon.* Electrochemical etching of the silicon in a HF-based electrolyte. Different porous sizes and porosity can be obtained.



□ *Wet etching of metal.* Wet etching of chrome, aluminium, titanium, nickel, gold, tungsten

□ *Wafers bonding.* Available process:

- anodic bonding (silicon-glass)
- fusion bonding (silicon-silicon)
- eutectic bonding (silicon-gold)

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