CeNSE
CENTRE FOR NANO SCIENCE AND ENGINEERING

Design: TheFool.in

CONTACT US

NATIONAL NANO FABRICATION CENTRE
CENTRE FOR NANO SCIENCE AND ENGINEERING (CeNSE)

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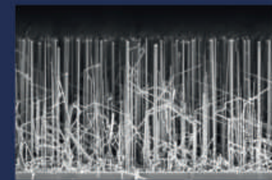
At NNFC, contamination controlled and dedicated furnaces are available to perform high temperature processes like deposition, dopant diffusion and metallization.

Conformal deposition in a trench



Ge nanowires grown on Si

FURNACES

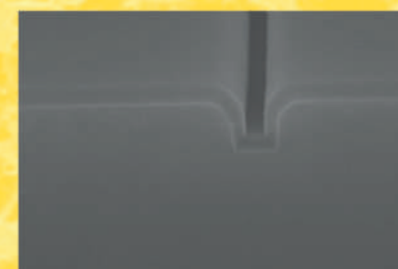
- 12 furnace tubes for dedicated processes
- Max temp 1100˚C
- Sample Size (small pieces to 4″ full wafers)
- Batch processing (25 wafers at a time)
- SiO_2, Poly-Si, Si_3N_4, SiGe, Doping and Diffusion

- Rapid Thermal Processing systems
- Up to 1200˚C, ramp rates 30˚- 200˚C/sec
- N_2, H_2, N_2O, NH_3 and O_2 gas lines
- Contact alloying, Oxidation and Nitridation
- Silicidation

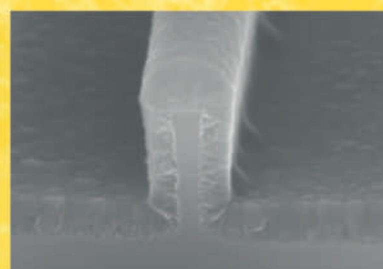
CVD AND THIN FILMS

PECVD

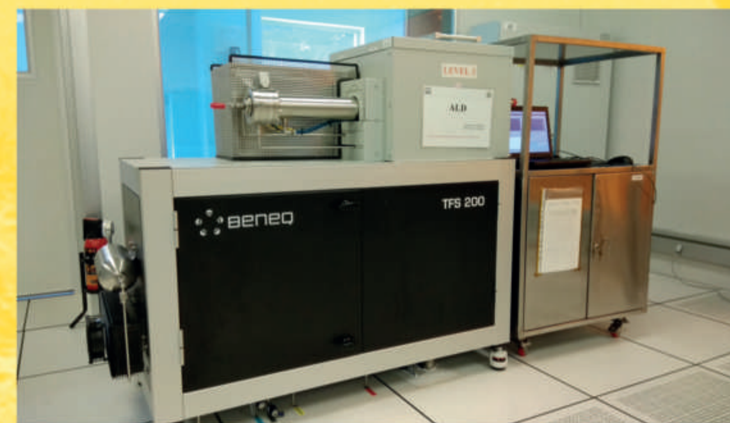
- 6″ wafers to small pieces
- Substrate temperature up to 400˚C
- Gases – H_2, SiH_4, GeH_4, CH_4, NH_3, CF_4, N_2O, N_2, Ar, 2% B_2H_6/Ar, 1% PH_3/Ar
- Materials: a-Si, SiO_2, Si_3N_4, SiC and SiGe



Conformal trench coverage



Conformal step coverage



ATOMIC LAYER DEPOSITION

- Up to 8″ wafer
- Substrate temperature range: 25˚- 400˚C
- Materials: Al_2O_3, TiO_2 and ZnO

RF & DC SPUTTER TOOLS

- Dedicated tools for metals and dielectrics
- More than 50 materials to sputter
- Multi-target and multi-wafer holders with planetary system
- 50˚- 600˚C substrate temperature range

E-BEAM EVAPORATION

- Dual e-gun and dual-hearth system
- Multi wafer holders (four) with planetary system
  Substrate temp up to 300˚C
- Max 6″ wafers to small pieces
- Co-evaporation and ion-assisted deposition possible
- 46 materials
- Ion-etching for pre-cleaning substrate

IN-LINE CHARACTERIZATION

- Ellipsometer
  12″ wafer capability
  Standard models for many materials
- Surface profiler
  Step height and 3D mapping
- Curvature profiler
- Contactless Hall mobility
- Four-point probe

WHAT WE OFFER

- Basic and advanced training in process technologies
- Access to a large range of process equipment in our cleanroom
- Consultancy and services ranging from unit or integrated process steps all the way up to prototyping a device

NATIONAL NANO FABRICATION CENTRE

OVERVIEW

National Nano Fabrication Centre (NNFC) is a national facility open to public and private academic institutes, private industries, public sector undertaking and Indian strategic sector.

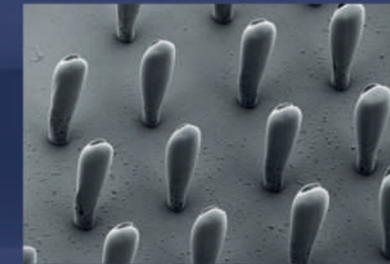
NNFC is a class 100 and class 1000 state-of-the-art fabrication facility spanning over an area of 14,000 sq ft, enabling More-Moore and More-than-Moore technologies including MEMS/NEMS, photonics, PV, spintronics, sensors, actuators and materials development.

Supported by 24/7 cleanroom utility and dedicated staff members, NNFC is capable of realizing micro and nanoscale devices on various substrates that include Si, GaN, SiC, Quartz, Glass, Graphene and III-V semiconductors.

LITHOGRAPHY

DIRECT WRITING AND MASK MAKING

- Minimum features down to 1 μm
- Alignment accuracy - 200 nm
- Sample/mask size: 6" wafer/mask down to small pieces
- Design file format - GDS2/CIF/DXF



SU8 structure array

1 micron gap between large structures

E-BEAM LITHOGRAPHY

- Accelerating voltage: 30 kV
- Apertures: 7.5, 10, 20, 30, 60, 120 μm
- Minimum feature size: Sub-10 nm
- SEM feature
- Spot size with 30 μm aperture
  @ 1 kV: 4 nm
  @ 20 kV: 2.1 nm

Housed in Class 100 area in the cleanroom, the lithography bay has several tools with minimum feature size patterning capability ranging from a few microns all the way down to a few nanometers.

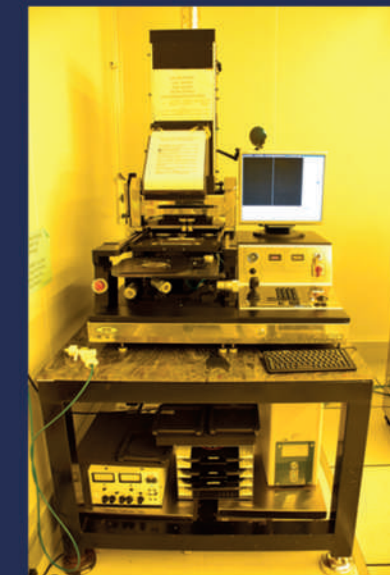
Bi-layer for lift-off process

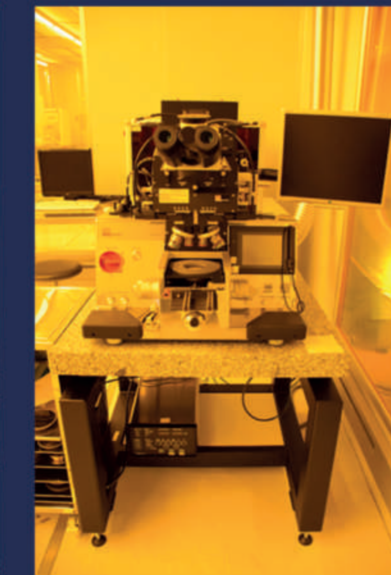
Contact pads for nanowires

50 nm structures

20 nm lines with 20 nm spacing

OPTICAL LITHOGRAPHY





- Minimum features down to 1 μm
- Alignment accuracy
  1 μm front side
  5 μm back side
- Sample size - 6" wafers down to small pieces
- Design file format - GDS2/CIF/DXF

1-micron lines

2-micron squares

Bi-layer lift-off process

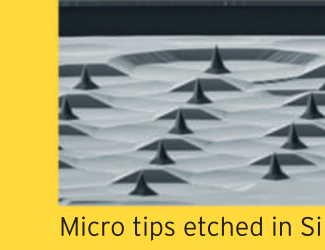
WAFER BONDER

- Up to 4" substrate and quarter wafer pieces can be handled
- Types of bonding available:
  Eutectic bonding (Si-Au-Si)
  Anodic bonding (Si-Glass)
  Fusion bonding (Si-Si)

WET ETCH

Dedicated wet benches to avoid cross-contamination

In NNFC cleanroom, dedicated wet processing stations are available for wafer cleaning and etching various materials.



Micro tips etched in Si

V-Groove structures in Si

Critical Point Drier (CPD)

HF vapour etch

Critical point drying and vapour-phase HF etching render stiction-free released structures.

Released RF MEMS switch

Released cantilevers

DRY ETCH

A special Deep Reactive Ion Etch (DRIE) equipment is used for through-Si wafer etching for MEMS applications.

RIE tools

Micro mirrors

Nano pillars etched in Si

- Dedicated Fl and Cl based chemistry
- Si, III-V, dielectric and metal etching
- Isotropic and anisotropic
- Input gases - O_2, Ar, C_4F_8, N_2, H_2, Cl_2, BCl_3, CH_4, HBr, SF_6, CHF_3
- 6" wafers to small pieces

DRIE tool

Floating rings etched in Si

- Dedicated to Si deep etch
- Through Si wafer via etch can be done
- Maximum Si etch rate ~ 30 μm/min
- Up to 50 aspect ratio in etch
- 6" wafers to small pieces