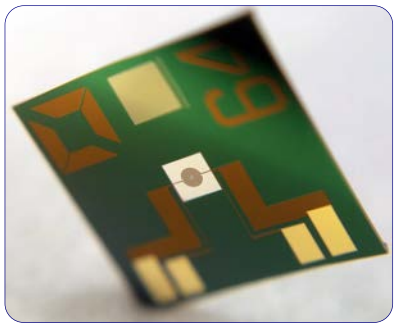
# NORCADA

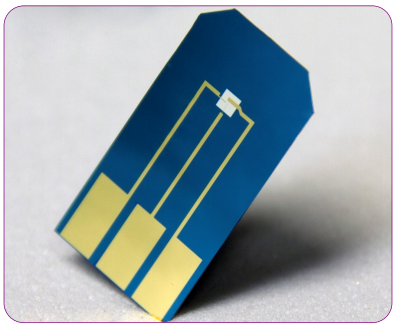
## A MEMS AND NANOTECHNOLOGY COMPANY

Norcada specializes in the development and manufacturing of MEMS and photonic devices for a wide range of industrial and scientific applications.

### Scientific Applications

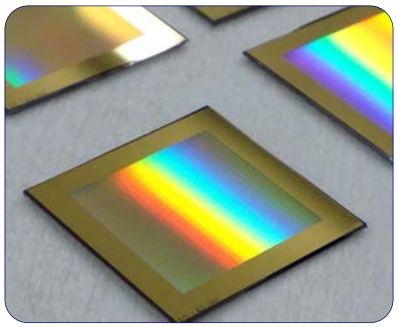
Norcada products include ultra-thin silicon and silicon nitride membrane based MEMS devices for Transmission Electron Microscopy (TEM) and X-ray analysis. With design and manufacturing capabilities in MEMS chips and specialty holders, Norcada can offer a wide range of solutions for in-situ microscopy.

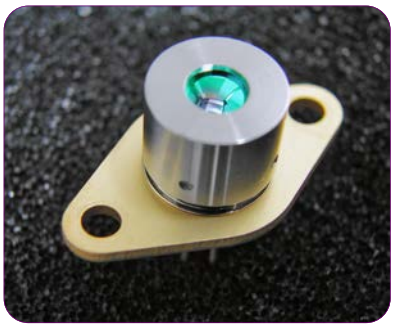




### Photonics Solutions

Our products include near-infrared and mid-infrared DFB lasers for spectroscopy, silicon optical bench devices for telecom, and thin film polarizers and filters for Terahertz applications.





Founded in 2002, Norcada serves a broad international customer base, and sells products to companies and research institutions worldwide.

### NORCADA MEMS

$Si_3N_4$ Membranes
Si Membranes
TEM Window Grids
X-Ray Windows
In-Situ MEMS solutions

### NORCADA PHOTONICS

Near-IR DFB Lasers
Mid-IR DFB Lasers
THz Filters and Polarizers
Silicon Optical Bench

### CONTACT:

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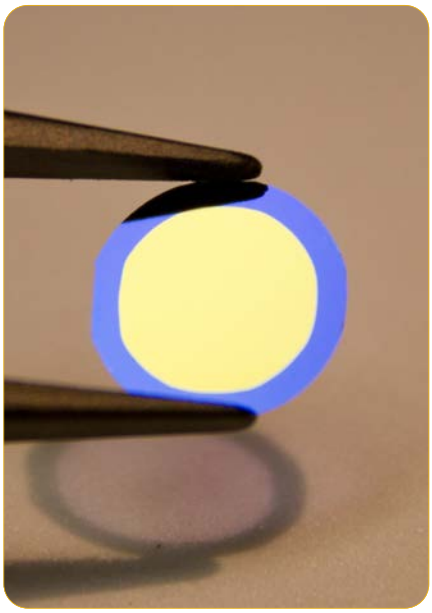
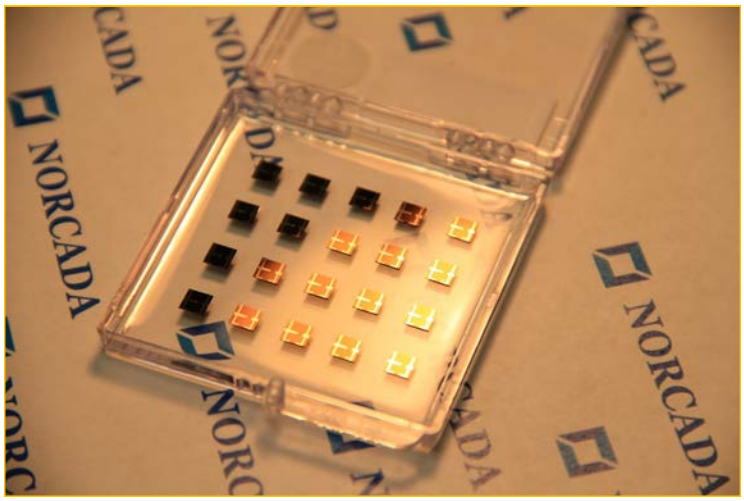
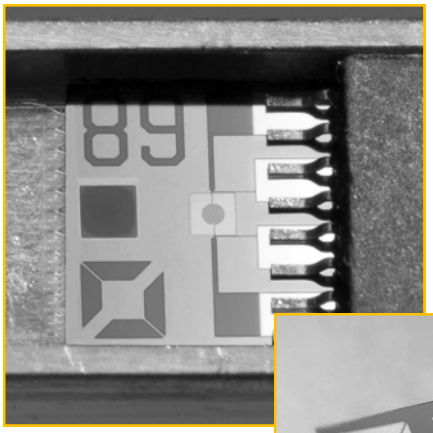


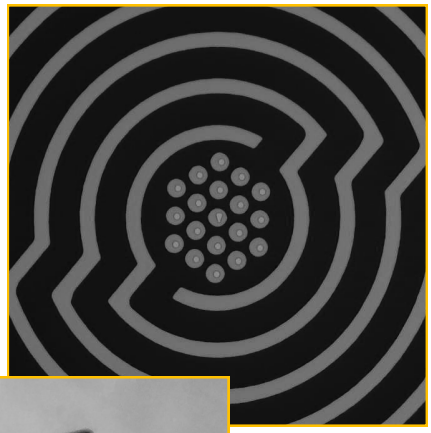
# NORCADA

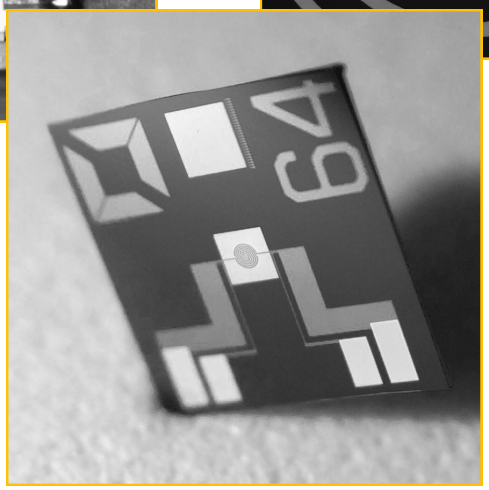
**NORCADA** manufactures Membrane Windows and MEMS sample holders for Electron, X-Ray and Ion microscopy applications.




## In-situ Heating Chips







## Membrane Materials:

- $Si_3N_4$
- $SiO_2$
- Crystalline Silicon
- Polymeric & Metallic layers

## Products & Solutions:

- Integrated Electrodes
- Heating Chips
- Electrochemistry Cells
- Liquid Cell Kits
- Porous Membranes
- Hydrophobic Surfaces
- Hydrophilic Surfaces
- Thin Film Coating

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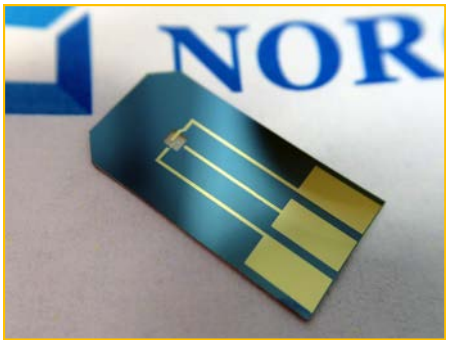
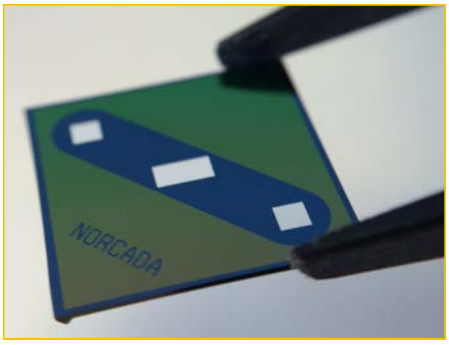
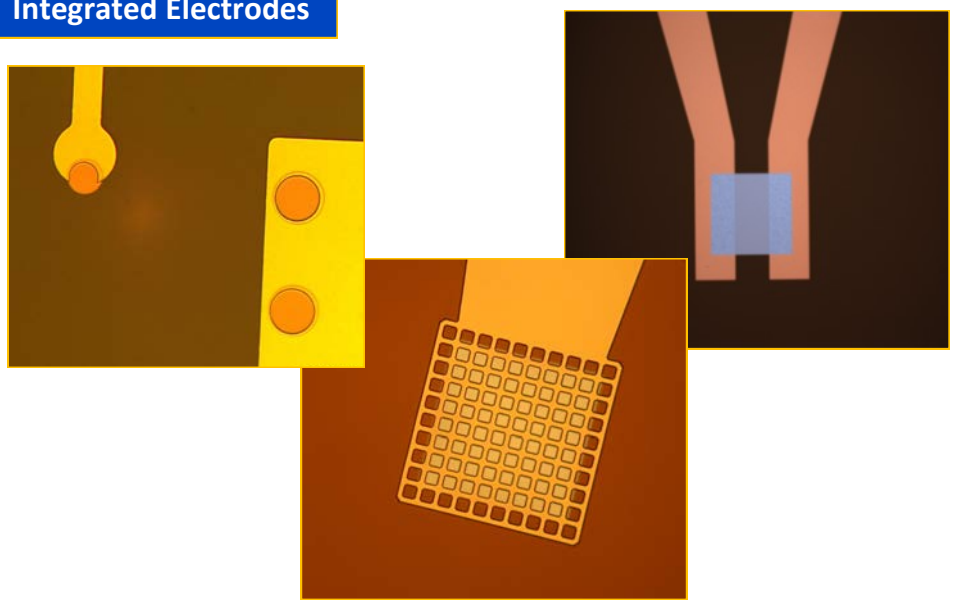
# NORCADA

## Electrochemistry and Liquid Cells

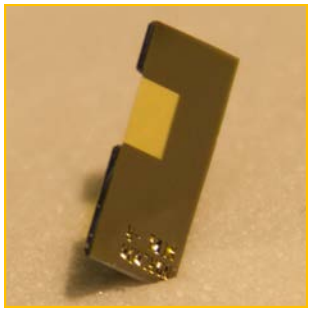


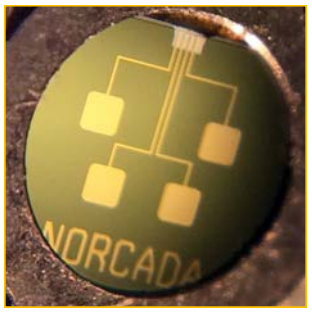




## Integrated Electrodes



## Tomography sample Biasing






## Membrane Materials:

$Si_3N_4$

$SiO_2$

Crystalline Silicon

Polymeric & Metallic layers

## Products & Solutions:

Integrated Electrodes

Heating Chips

Electrochemistry Cells

Liquid Cell Kits

Porous Membranes

Hydrophobic Surfaces

Hydrophilic Surfaces

Thin Film Coating

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# NORCADA

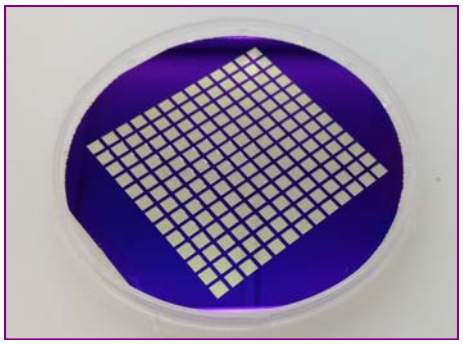
## Silicon Nitride Membrane Windows

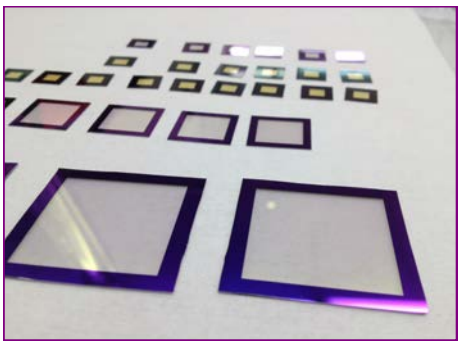
**Norcada** manufactures a wide range of high quality silicon nitride windows for the X-ray, IR, and UV spectroscopy research applications.

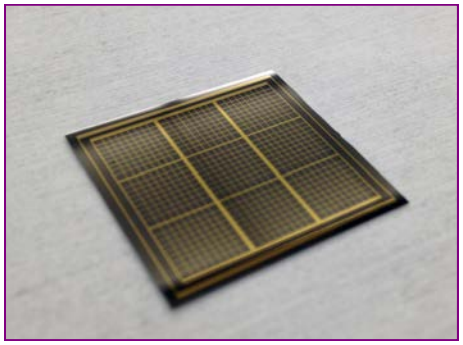
Our silicon nitride windows are fabricated on silicon frames with different window and frame sizes to choose from. The silicon nitride is made in 5nm to 2000nm thickness range. The membranes are low stress and robust, making them ideal for mounting samples for spectroscopy and X-Ray experiments.

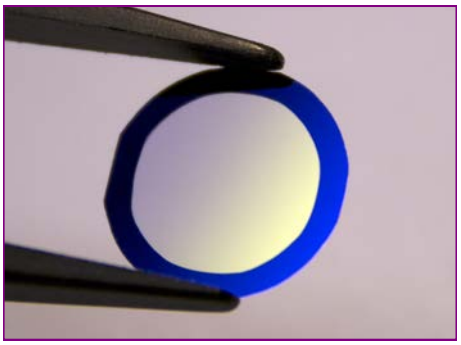
**Norcada** Silicon Nitride membranes are made in square, polygon and circular membrane and frame shapes.

We also specialize in fabrication of custom designed in-situ experimental cells and holders using our membrane platforms.









Norcada warrants the quality of its products, and will replace any device deemed unusable due to fabrication defects within 60 days of purchase. All Norcada products are manufactured and packaged in a Class 100 Cleanroom.

## Membrane Materials:

- $Si_3N_4$ Membranes
- $SiO_2$ Membranes
- Si Membranes

## Custom Solutions:

- Integrated Electrodes
- Thin Film Coating
- Heating Chips
- Electrochemistry Cells
- Liquid Cell Kits
- Holey Patterns
- Hydrophobic Surfaces
- Hydrophilic Surfaces
- Dual Thickness Membranes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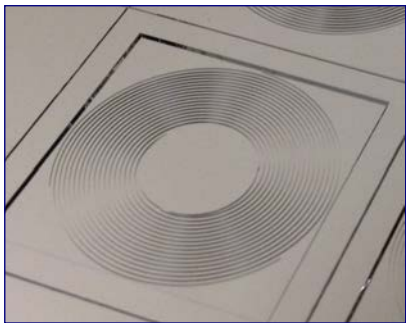
# NORCADA

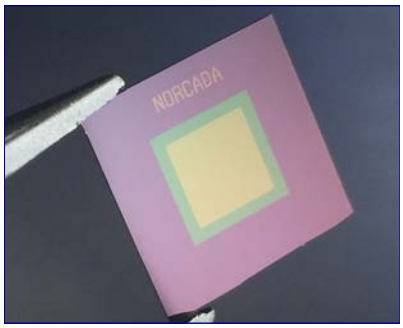
## Silicon Membrane Windows

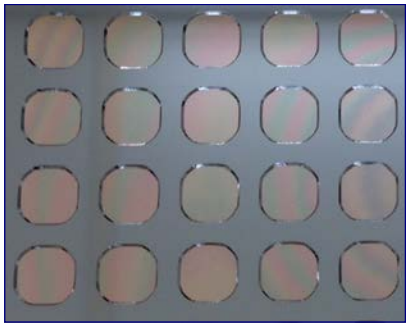
**Norcada** manufactures both standard and custom single-crystal and polycrystalline silicon membrane windows.

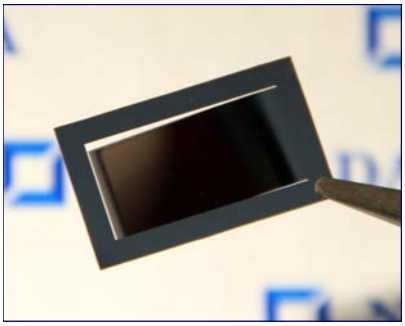
Our single-crystal silicon membranes are utilized in a variety of scientific applications as beam splitters, vacuum windows and resonant structures. Single crystal silicon membranes are available with (100), (110) and (111) crystal orientations and with thicknesses ranging from 30nm to 50µm. Custom designs can include integration of metal features, specific doping and sculptured structures.

Norcada's poly-silicon membranes are ideal for X-ray, UV and IR applications. These devices are quite robust, allowing for post fabrication processing, and are available with membranes ranging from 10nm to 300nm in thickness.







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## Membrane Materials:

- $Si_3N_4$ Membranes
- $SiO_2$ Membranes
- Si Membranes

## Custom Solutions:

- Integrated Electrodes
- Thin Film Coating
- Flexible/Bending Membranes
- Hole and Slot Patterns
- Hydrophobic Surface
- Hydrophilic Surface
- Dual Thickness Membranes

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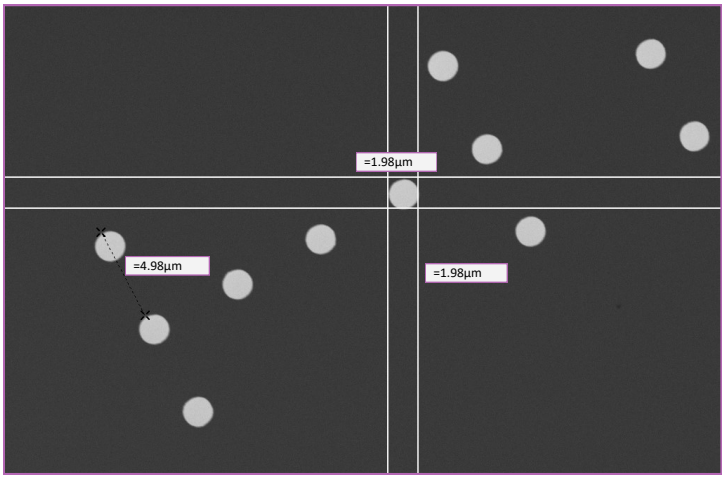
NORCADA

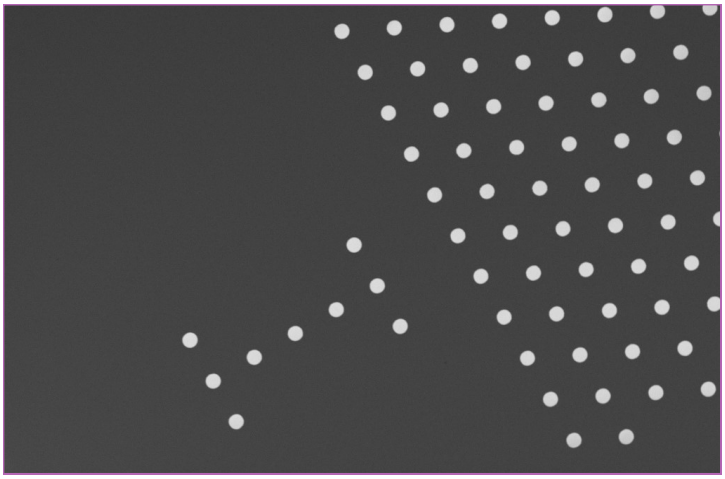
NANOTECHNOLOGY & MICROSCOPY

# NORCADA MICRO-POROUS LOCATION-TAGGED TEM DEVICES

## Features

- Silicon Nitride film with a Micro-Porous pattern and tagged locations
- Part Numbers NH050A2 and NH050D2 contain 2µm Holes with 5µm pitch
- The membrane is mechanically robust and is fabricated in 50nm and 200nm thicknesses
- These devices can be used in high beam intensity TEM
- Devices with 5µm, 10µm, 20µm and 30µm holes also available



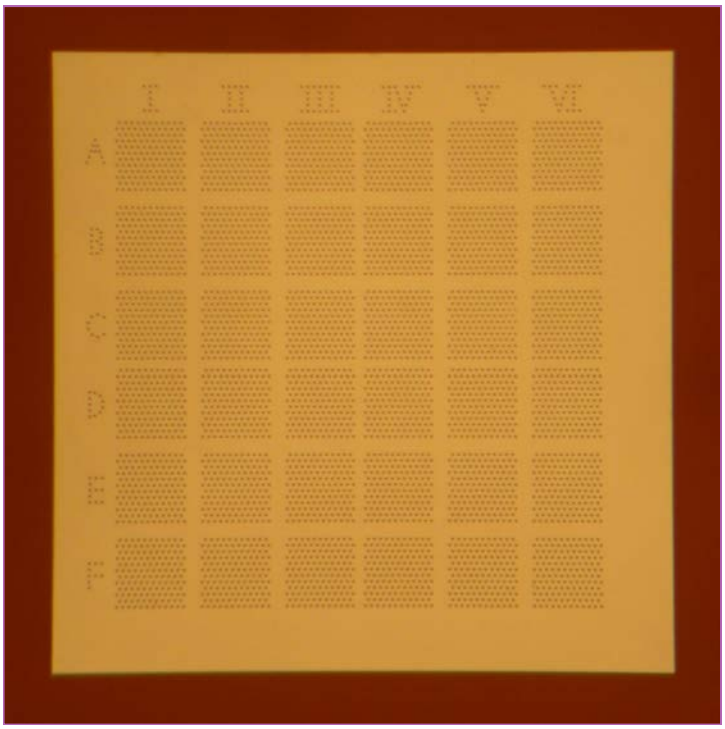



## Applications

The advantage of these membranes is that the films will provide a supportive platform for overhanging samples that are placed over the edge of Micro-Pores.

2D material, string-shaped material and ultrathin films can be transferred to or grown on top of the membrane and across the pores.

These membranes have been tested in high resolution TEM, STEM and X-Ray microscopes.

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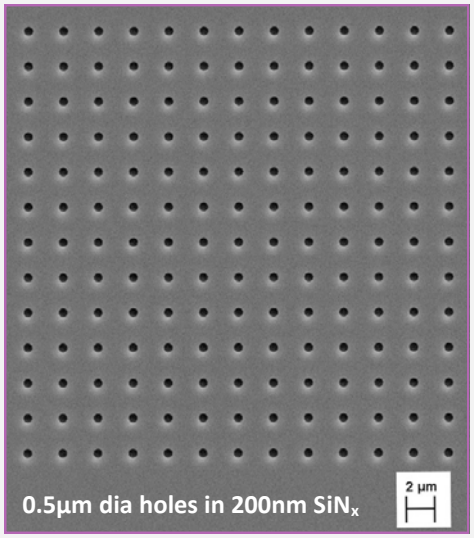
NORCADA

NANOTECHNOLOGY & MICROSCOPY

# NORCADA NANO-POROUS TEM DEVICES

## Features

- Nano-Porous Silicon Nitride membranes
- Nanoscale Holes with 100nm to 1µm diameter
- Membrane thickness: 50nm to 200nm
- Custom holes sizes and patterns available
- Available in Silicon and Silicon Dioxide membrane options
- Custom coatings for surface functionalization



0.5µm dia holes in 200nm $SiN_x$

| Part Number | Window Size | Nitride Thickness | Pore Diameter | Pitch | Arrays Size | Number of Arrays | Price Pack of 10 |
|---|---|---|---|---|---|---|---|
| **NH005A01** | 0.05x0.05mm | 50nm | 100nm | 2x Diameter | 25x25 | 1 | $390.00 |
| **NH005A03** | 0.05x0.05mm | 50nm | 300nm | 2x Diameter | 25x25 | 1 | $370.00 |
| **NH005A05** | 0.05x0.05mm | 50nm | 500nm | 2x Diameter | 25x25 | 1 | $370.00 |
| **NH005A1** | 0.05x0.05mm | 50nm | 1000nm | 2x Diameter | 15x15 | 1 | $370.00 |
| **NH050A03** | 0.5x0.5mm | 50nm | 300nm | 5x Diameter | 25x25 | 4 | $400.00 |
| **NH050A05** | 0.5x0.5mm | 50nm | 500nm | 5x Diameter | 25x25 | 4 | $400.00 |
| **NH050A1** | 0.5x0.5mm | 50nm | 1000nm | 5x Diameter | 15x15 | 4 | $400.00 |
| **NH050AVA** | 0.5x0.5mm | 50nm | 100nm, 300nm, 500nm & 1000nm | 5x Diameter | 25x25 | 4 one per pore size | $400.00 |

| Part Number | Window Size | Nitride Thickness | Pore Diameter | Pitch | Arrays Size | Number of Arrays | Price Pack of 10 |
|---|---|---|---|---|---|---|---|
| **NH005D03** | 0.05x0.05mm | 200nm | 300nm | 2x Diameter | 25x25 | 1 | $370.00 |
| **NH005D04** | 0.05x0.05mm | 200nm | 400nm | 2x Diameter | 25x25 | 1 | $350.00 |
| **NH005D05** | 0.05x0.05mm | 200nm | 500nm | 2x Diameter | 25x25 | 1 | $350.00 |
| **NH005D1** | 0.05x0.05mm | 200nm | 1000nm | 2x Diameter | 15x15 | 1 | $350.00 |
| **NH050D03** | 0.5x0.5mm | 200nm | 300nm | 5x Diameter | 25x25 | 4 | $390.00 |
| **NH050D05** | 0.5x0.5mm | 200nm | 500nm | 5x Diameter | 25x25 | 4 | $390.00 |
| **NH050D1** | 0.5x0.5mm | 200nm | 1000nm | 5x Diameter | 15x15 | 4 | $390.00 |
| **NH050DVA** | 0.5x0.5mm | 200nm | 300nm, 400nm, 500nm & 1000nm | 5x Diameter | 25x25 | 4 one per pore size | $390.00 |

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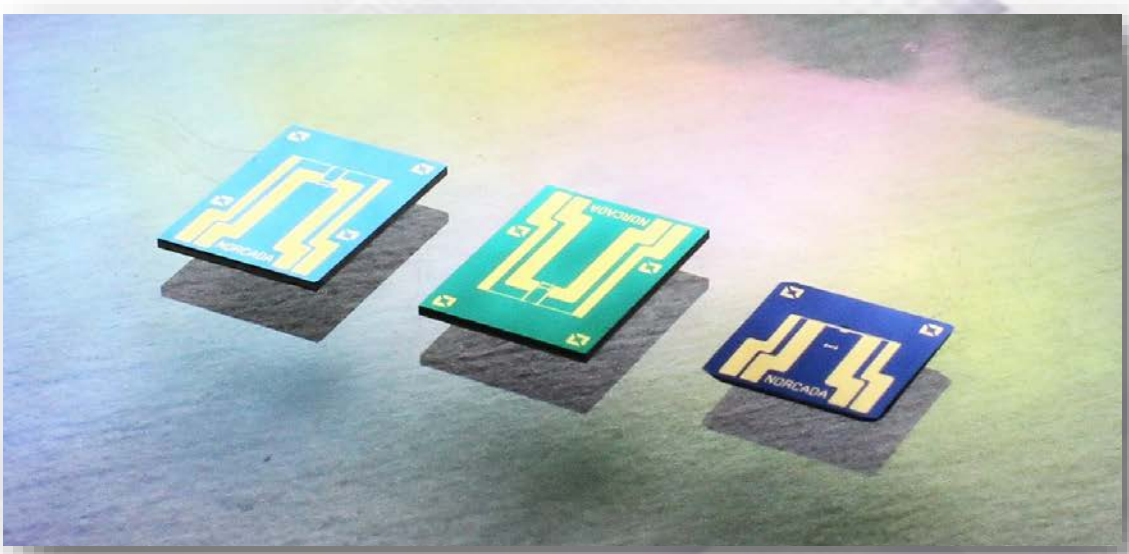
NORCADA

*Specification Sheet*

# In-Situ E-Biasing Chips

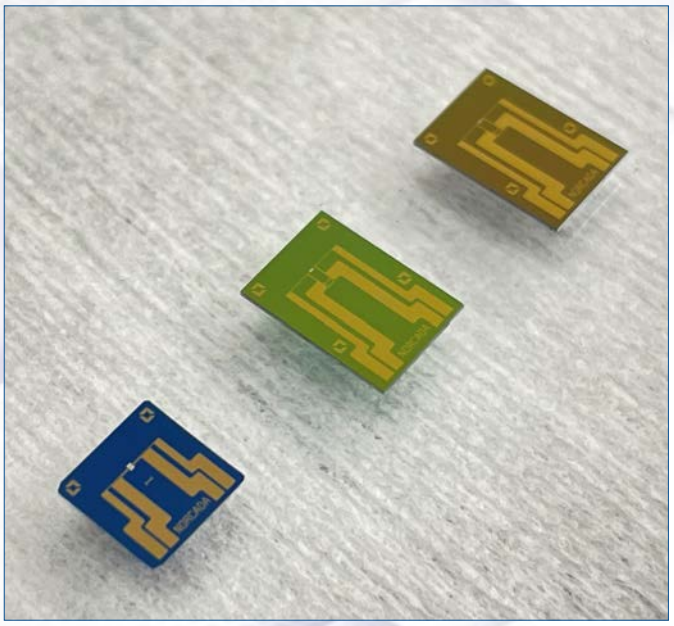


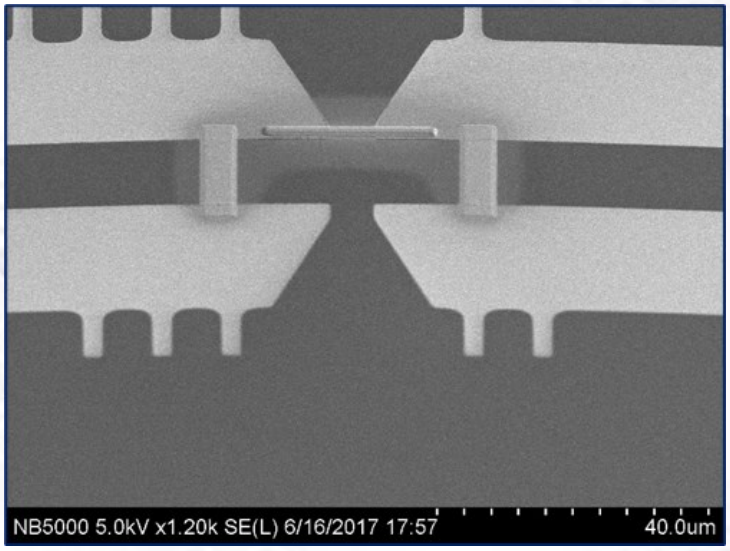
NORCADA

# *Specification Sheet*

## General Specifications

- Biasing chips for in-situ analysis in Electron and X-ray microscopes
- Norcada's unique MEMS technology
- Ideal for both AC and DC biasing
- Reliable I/V Cycling platform
- 2-Probe and 4-Probe configurations
- Minimum 10 kS/s standard sample rate
- Compatible with Hitachi TEM and SEM holders
- Cross-compatible with Norcada Heating and Biasing Holders for X-ray microscopy
- Ultra-high vacuum compatible






**FIB-prepared sample on Electrode on Membrane device**

- Two main configurations: Electrode on membrane and Electrode on gap (FIB)
- Noble metal leads for low-loss measurement
- Standard electrodes with Gold or Platinum
- Electrical noise cancelling layers built into every chip's structure
- 20 standard electrode configurations
- Flexible room for custom E-biasing layouts
- Custom designs with up to 32 leads per chip
- Accommodating Nano-electrodes
- Cryo or high temperature compatible devices

NORCADA

# *Specification Sheet*

## Electrode on Gap - FIB

**Frame Specifications:**

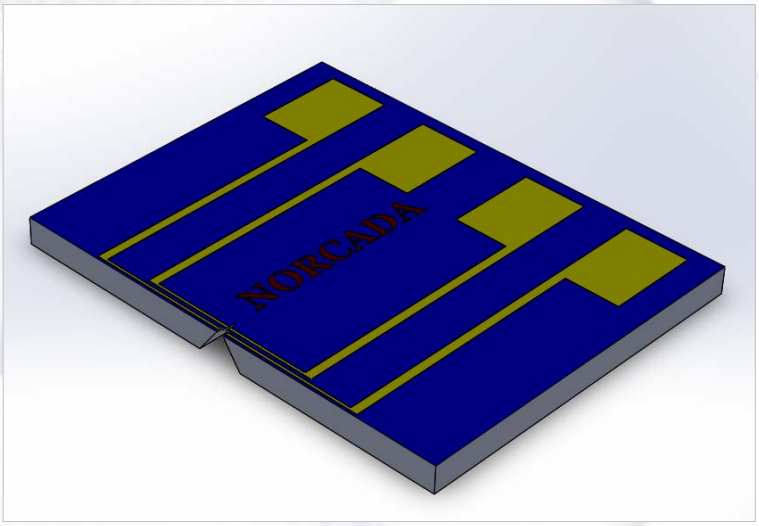
- Material: Silicon, Low or High Resistivity
- Outer dimensions: 3.9mmx5mm
- Thickness: 200µm
- Semiconductor-grade Noise Reduction Dielectrics

**Sample Gap Specifications:**

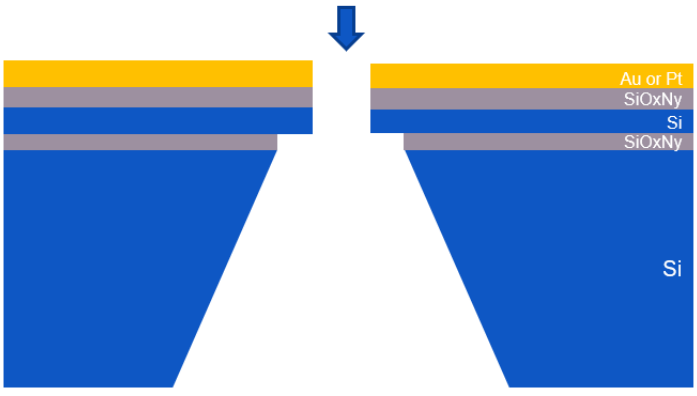
- Two chip configurations
- Gap on Membrane more precise than Gap on Chip
- Size: 10µmx80µm to 20µmx130µm

**Electrode Specifications:**

- 2 Probe and 4 Probe Layout
- 5µm to 50µm Electrode Gap
- Gold or Platinum Standard Electrode Material

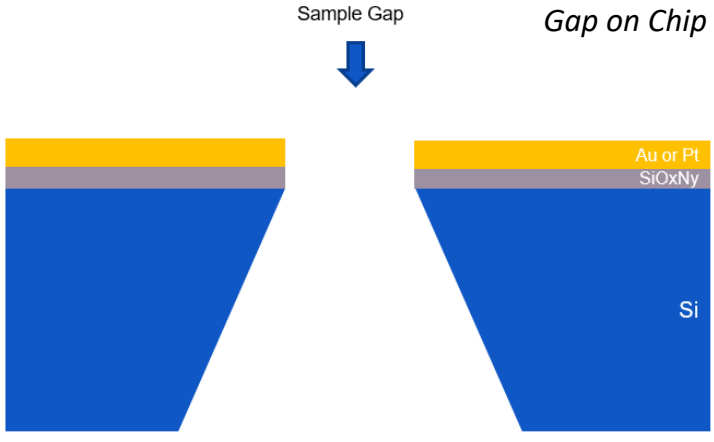



*Gap on Membrane*




Sample Area Cross-section Schematic

*Gap on Chip*




Sample Area Cross-section Schematic

NORCADA

# *Specification Sheet*

## Electrode on Membrane

**Frame Specifications:**

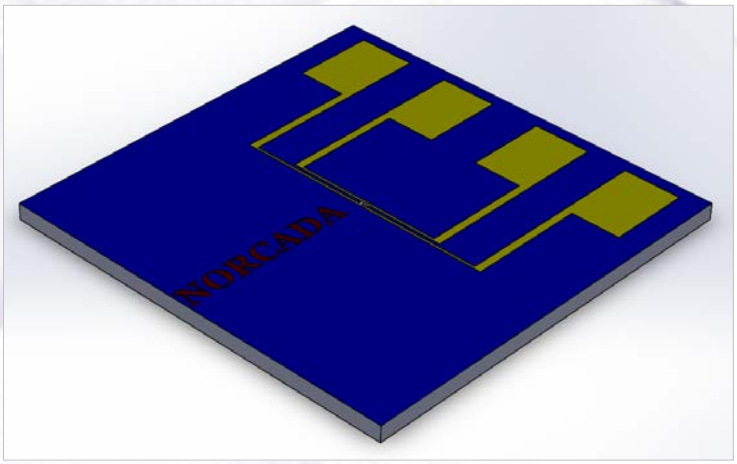
- Material: Silicon, Low or High Resistivity
- Outer dimensions: 5mmx5mm or 5mmx7mm
- Thickness: 200µm or 300µm
- Semiconductor-grade Noise Reduction Dielectrics

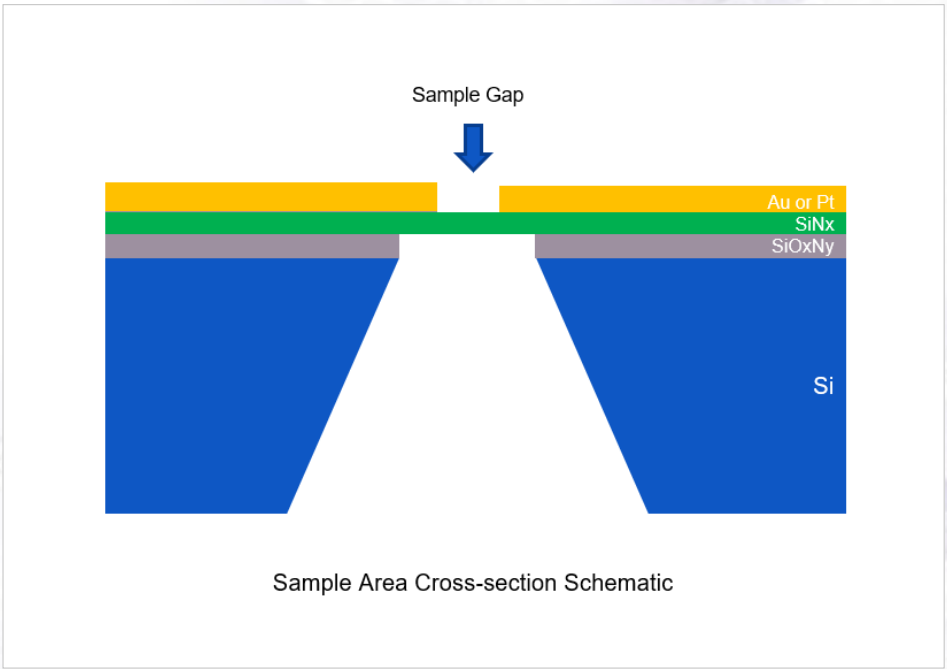
**Membrane Specifications:**

- Material: NORCADA Optimized SiNx
- Dimensions: 10µmx10µm to 500µmx500µm
- Thickness: 20nm to 100nm

**Electrode Specifications:**

- 2 Probe and 4 Probe Layout
- 5µm to 50µm Electrode Gap
- Gold or Platinum Standard Electrode Material




Sample Area Cross-section Schematic

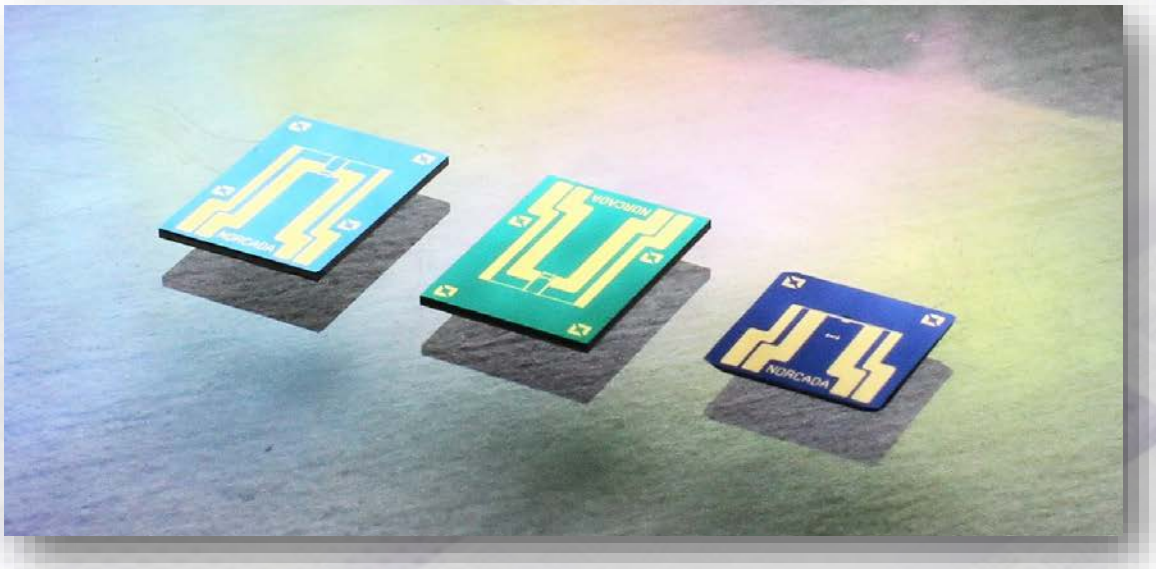
NORCADA

# *Specification Sheet*

## General Specifications

- Biasing chips for in-situ analysis in TEM
- Norcada's unique MEMS technology
- Ideal for both AC and DC biasing
- Reliable I/V Cycling platform
- 2-Probe and 4-Probe configurations
- Compatible with Mel-Build TEM holders
- Ultra-high vacuum compatible

- Cryo-Biasing compatible
- Platinum electrodes for low-loss measurement
- Flexible room for custom E-biasing layouts
- Custom designs with up to 8 leads per chip
- Accommodating Nano-electrodes
- Electrical noise cancelling layers built into every chip's structure



NORCADA

# *Specification Sheet*

## Electrode on Gap - FIB

**Frame Specifications:**

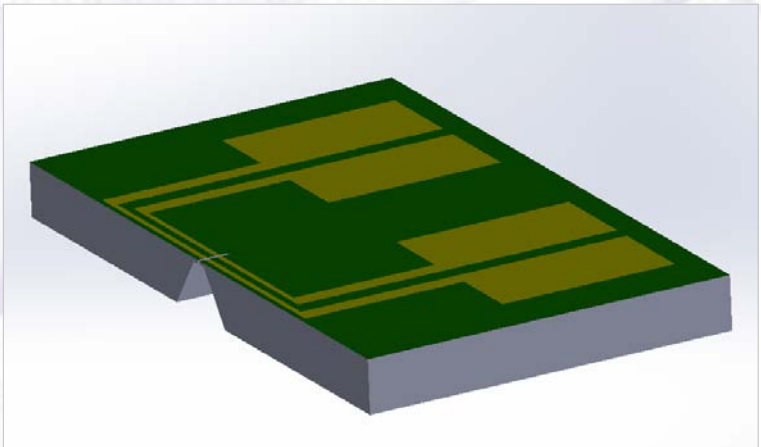
- Material: Silicon, High Resistivity
- Semiconductor-grade Noise Reduction Dielectrics

**Sample Gap Specifications:**

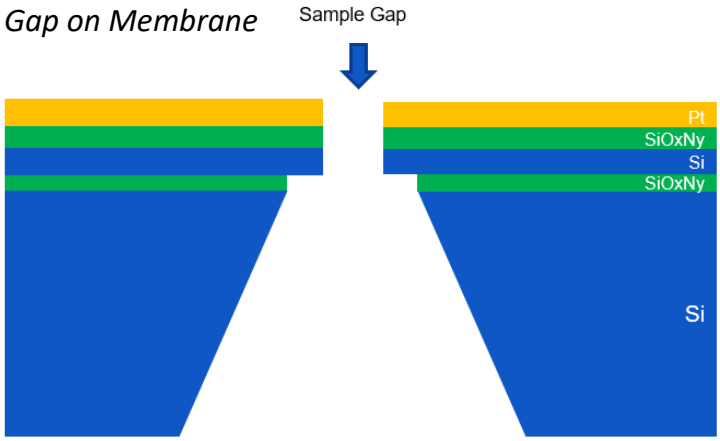
- Two chip configurations
- Gap on Membrane allow more precise sample sizes than Gap on Chip
- Size: 10µmx100µm

**Electrode Specifications:**

- 2 Probe and 4 Probe Layout
- 10µm Electrode Gap
- Platinum Standard Electrode Material

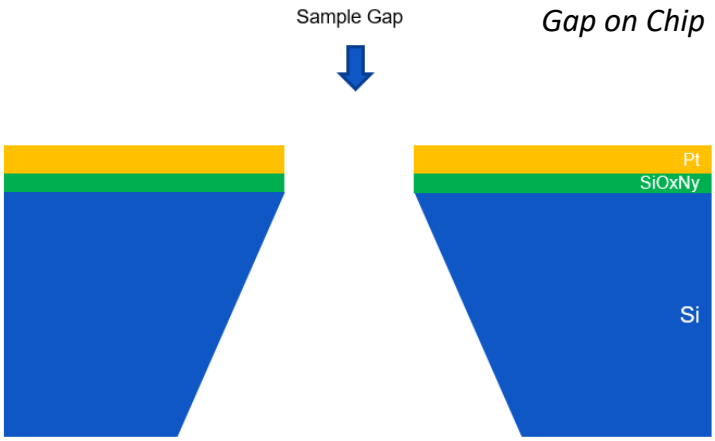


*Gap on Membrane*




Sample Area Cross-section Schematic

*Gap on Chip*




Sample Area Cross-section Schematic