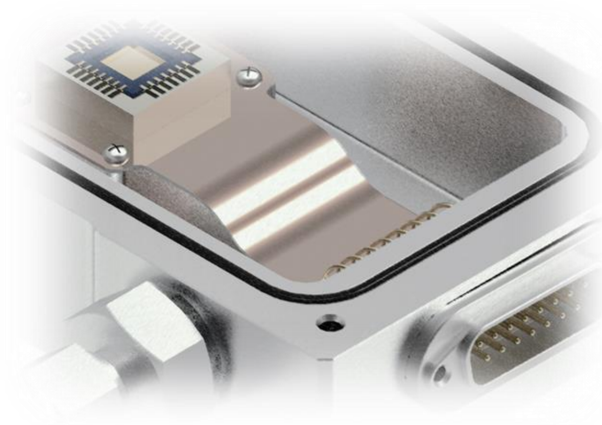
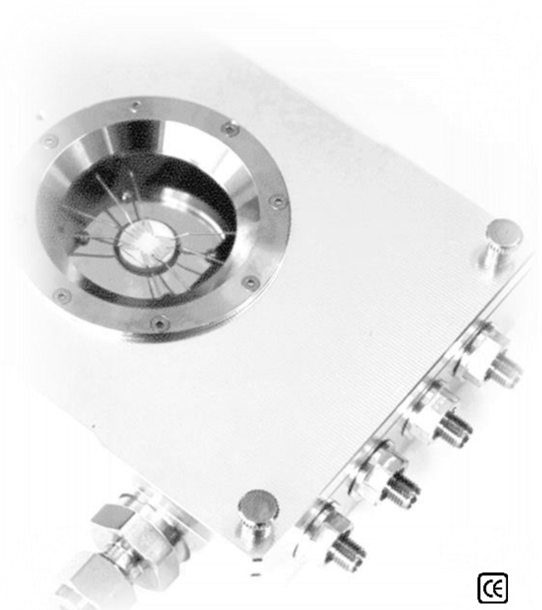
Micro
Probe System

Measurement Solution for
Electric-
Dielectric-
Optic-





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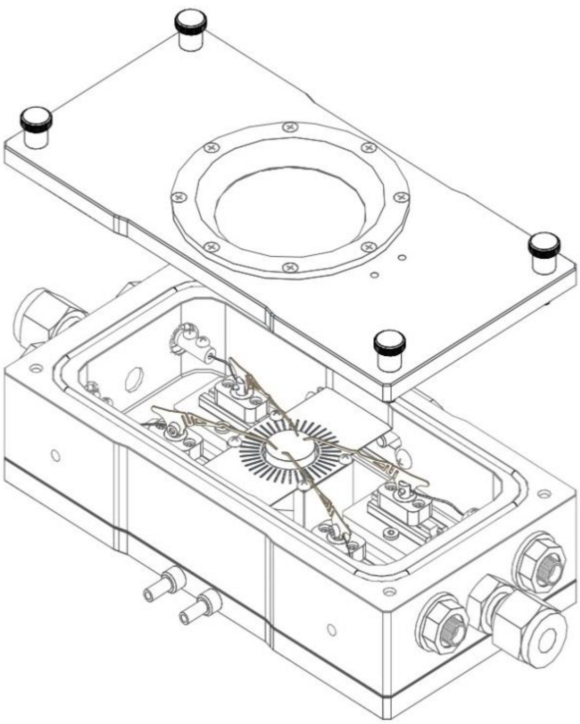
The Most Compact Probe System



Small volume

Vacuum

All chamber are vacuum tested* to
10^{-3} mbar (with rotary pump)
10^{-6} mbar (with Turbomolecular pump)

Micro Probe System is suitable to analyze the Electrical & Optical properties of the materials. Its advantage is the in-situ measurement of the electrical and optical properties under the various environmental conditions; Vacuum, Temperature, Gas flow, Humidity, Irradiation of light.

unrestricted

Custom Micro Probe System

NEXTRON R&D team is ready to discuss your complex needs !

Overview : Advise us on your specific requirements.

3D Modeling : Our dedicated team will work one-on-one with you to design a customized chamber to meet your needs. And then, 3D image copy will be provided with a budgetary quote. If necessary, this process will be repeated until meeting the requirements.

Production : The custom order will be made by the most advanced high-tech machining equipment.

dimension

number of probes

vacuum & pressure level

electric current level

optical components

temperature range

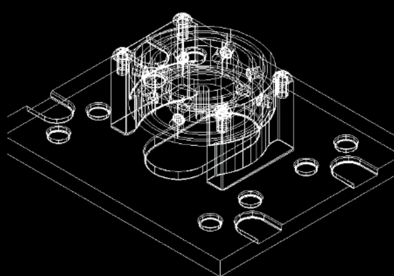
AC measurement

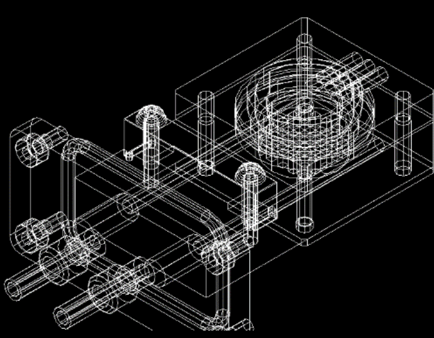
humidity control

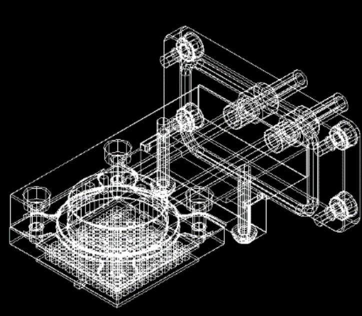
applied voltage

probe tip size

Temperature Ranges







RT ~ +1000 ℃
(Model : MPS – CHU)

RT ~ +750 ℃
(Model : MPS – CHH)

RT ~ +450 ℃
(Model : MPS – CHL)

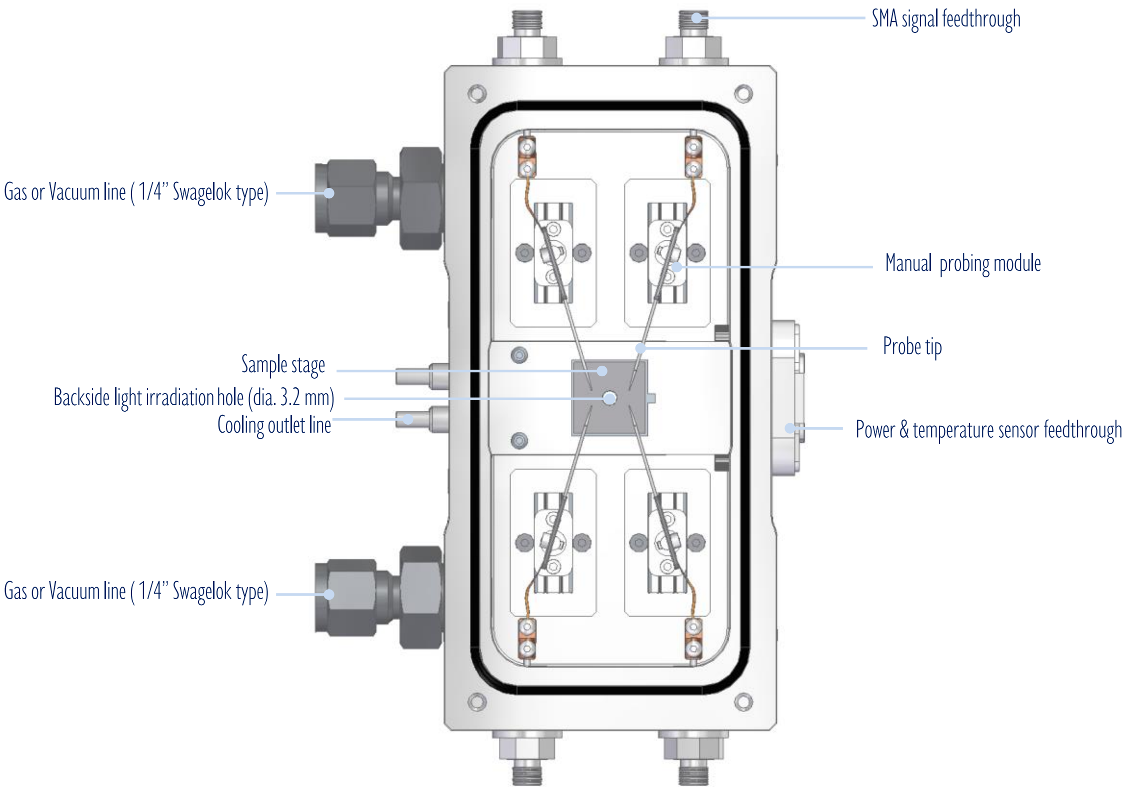
-40 ℃ ~ +200 ℃
(Model : MPS – PT)

-40 ℃ ~ +170 ℃
(Model : MPS – PTH)

80 K ~ 373 K
(Model : MPS – LN2)

Main Probe System Structure

MPS - PTH

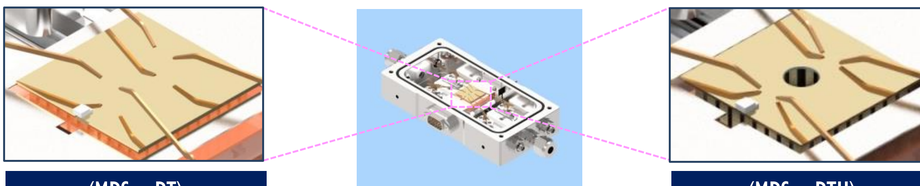


6 Versions Depending on Temperature

Peltier device heating & cooling sample stage

1
- Temp.: -40 ℃ ~ +200 ℃
- Sample stage size : 18 × 18 mm
- Sample stage material : AlN

2
- Temp.: -40 ℃ ~ +170 ℃
- Sample stage size : 15 × 15 mm
- Sample stage material : AlN
- Ø3.2mm hole for light irradiation



(MPS – PT)

(MPS – PTH)

Ceramic heater sample stage

3
- Temp. : RT ~ +450 ℃
- Sample stage size : dia. 1/2 inch
- Alumina sample stage
- No need cooling system

4
- Temp. : RT ~ +750 ℃
- Sample stage size : dia. 1/2 inch
- Alumina sample stage
- Built-in cooling block

5
- Temp. : RT ~ +1000 ℃
- Sample stage size : dia. 1/2 inch
- Alumina sample stage
- Built-in cooling block

(MPS – CHL)

(MPS – CHH)

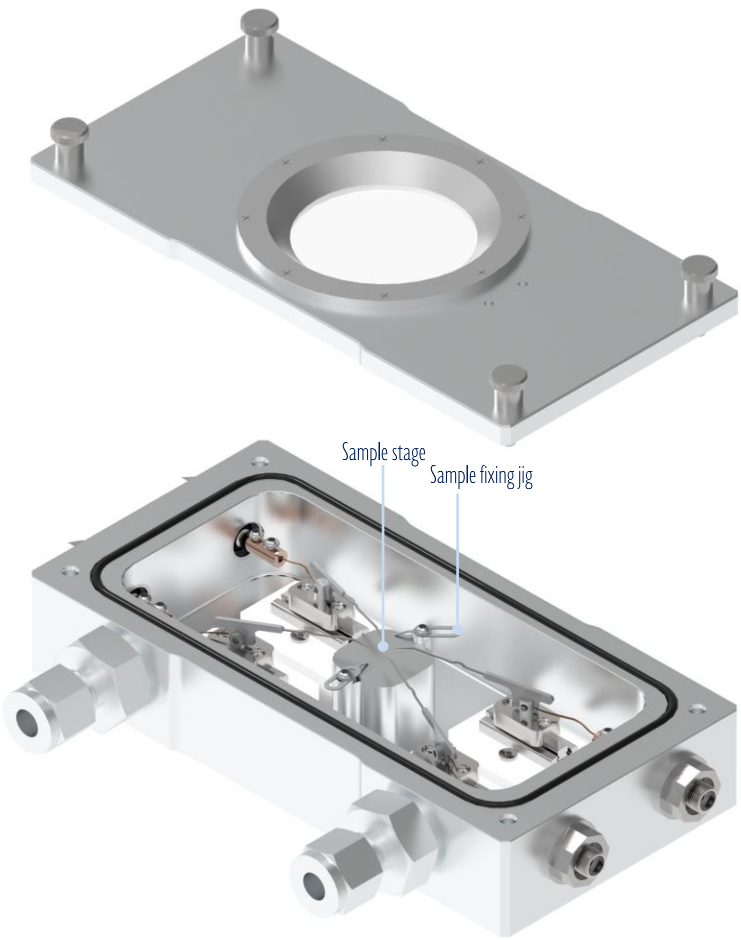
(MPS – CHU)

Liquid nitrogen cooling sample stage

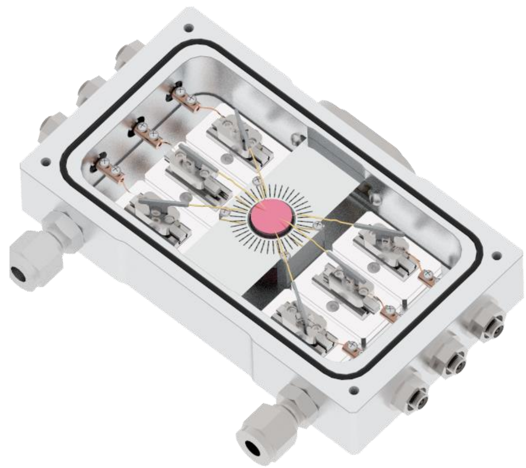
6
- Temp.: 80 K ~ 373 K
- Sample stage size: Ø 15mm
- Cu sample stage

(MPS – LN2)

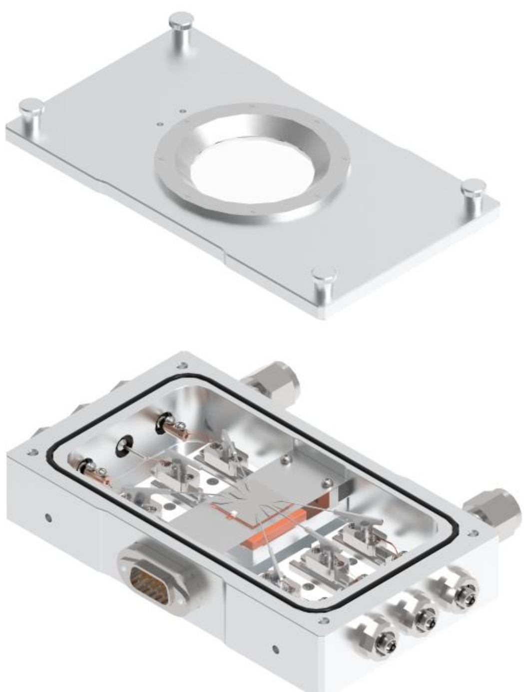
Micro vacuum Probe System without Heater



6-Channel Micro Probe System

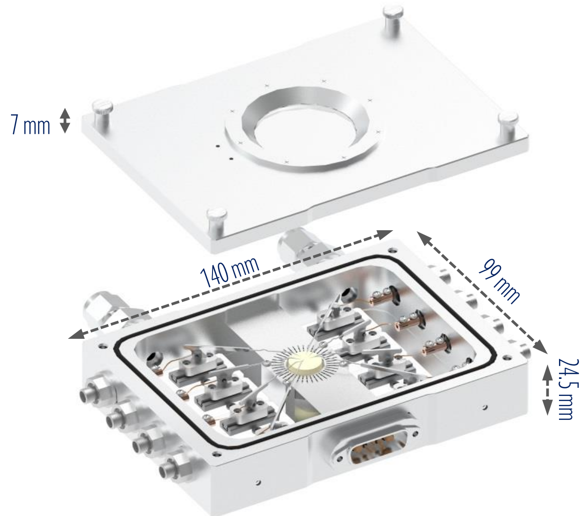


RT ~ 750℃



-40℃ ~ 200℃

8-Channel Micro Probe System for MEMS Devices

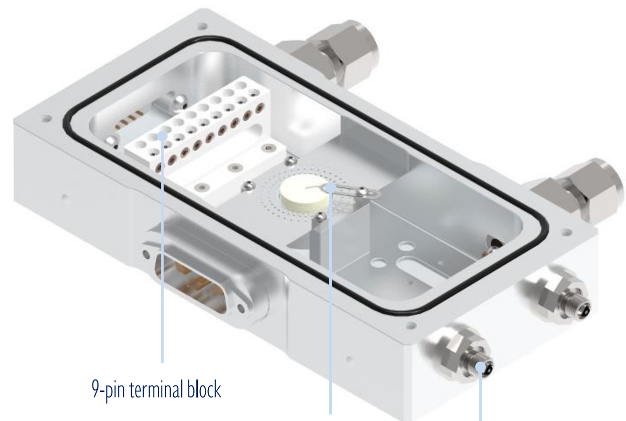


RT ~ 750℃

-40℃ ~ 170℃
(For transmittance measurement)

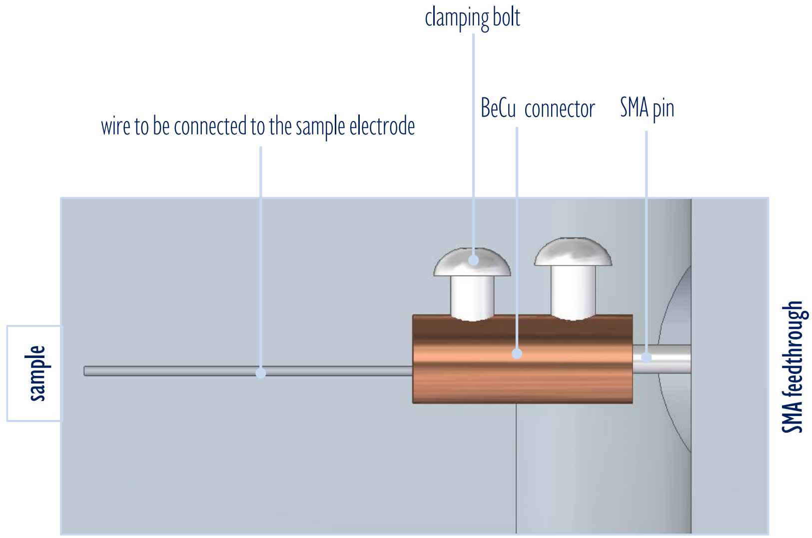
-40℃ ~ 200℃

Terminal Block Micro Probe System

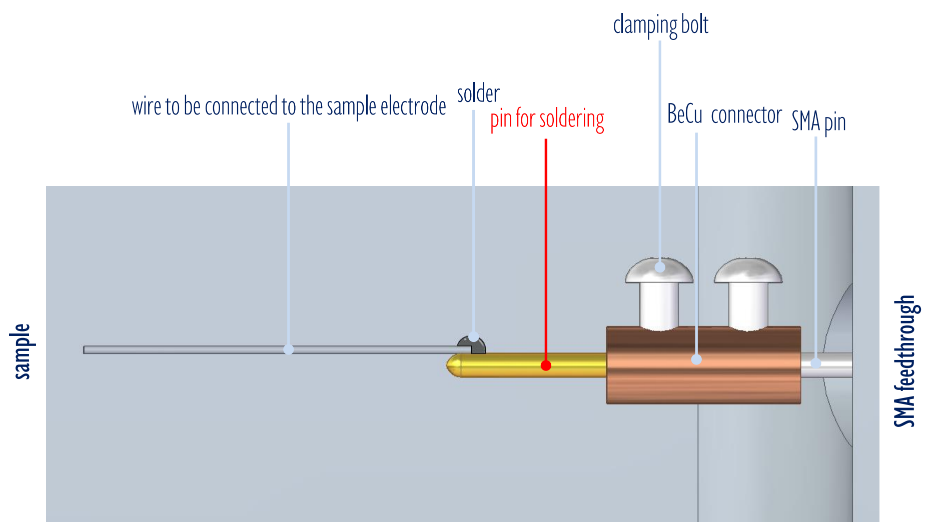


9-Pin Multipin Feedthrough

Scheme of Wiring



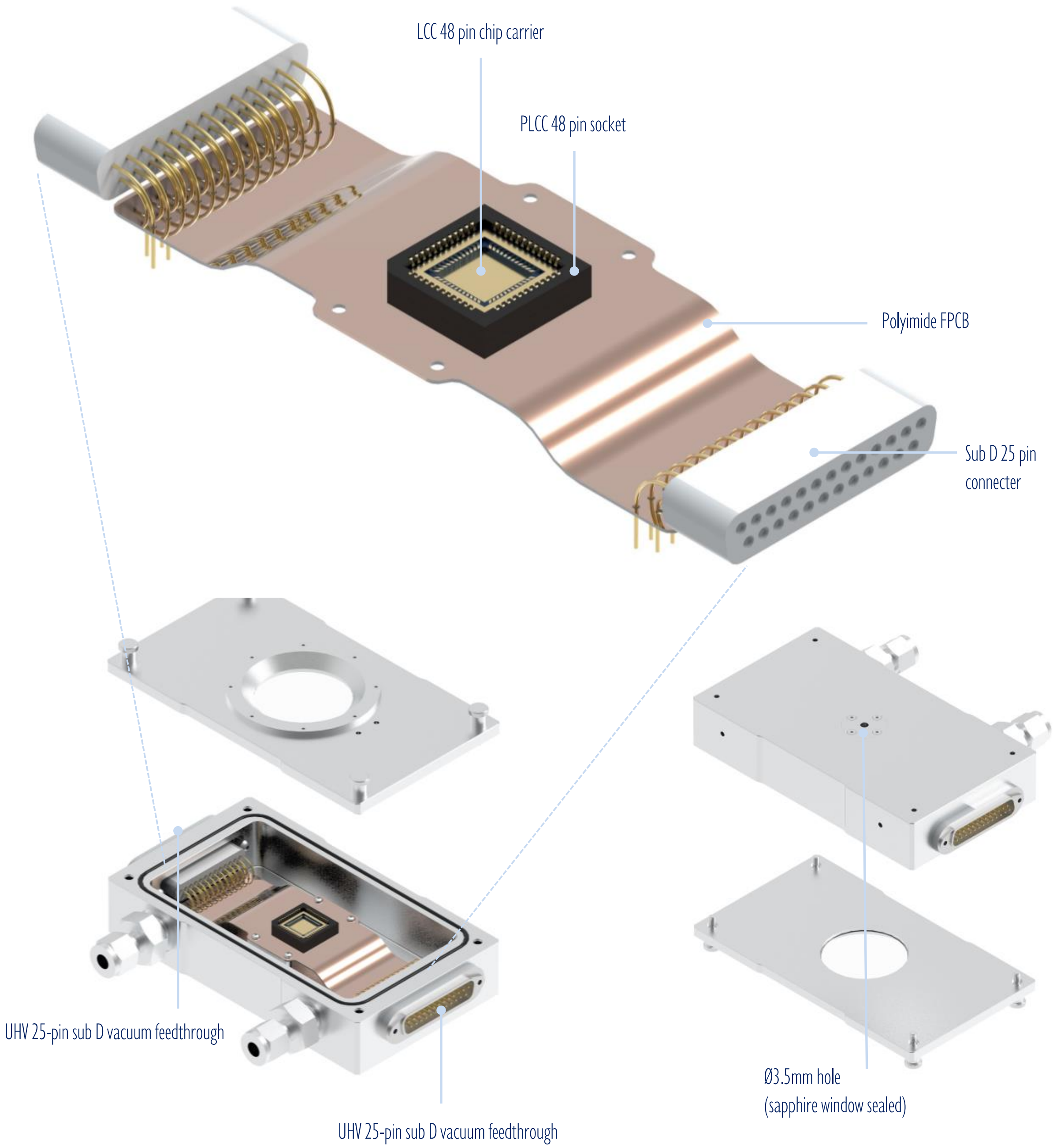
Scheme of wire clamping
(Recommended for thick wire)



Scheme of wire soldering
(Recommended for fine wire)

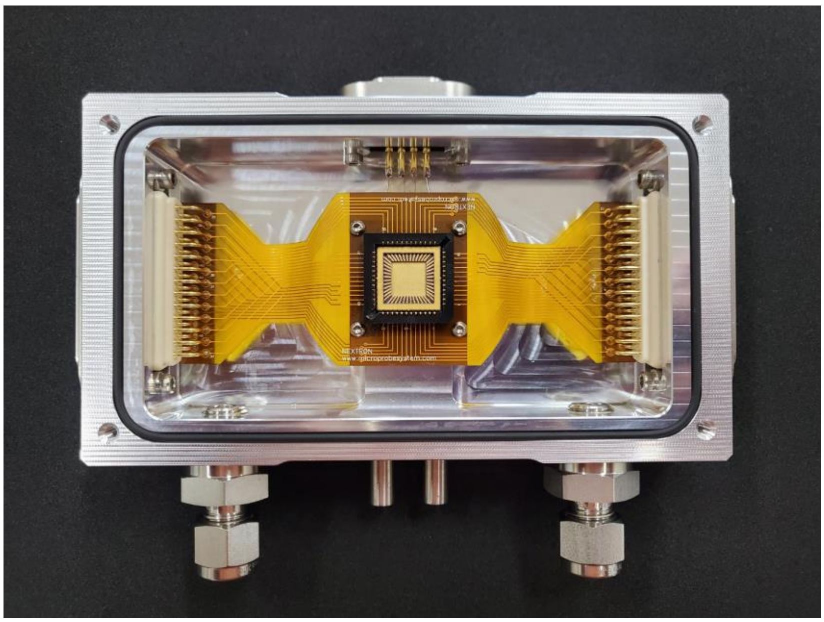
Micro Probe System for LCC Chip

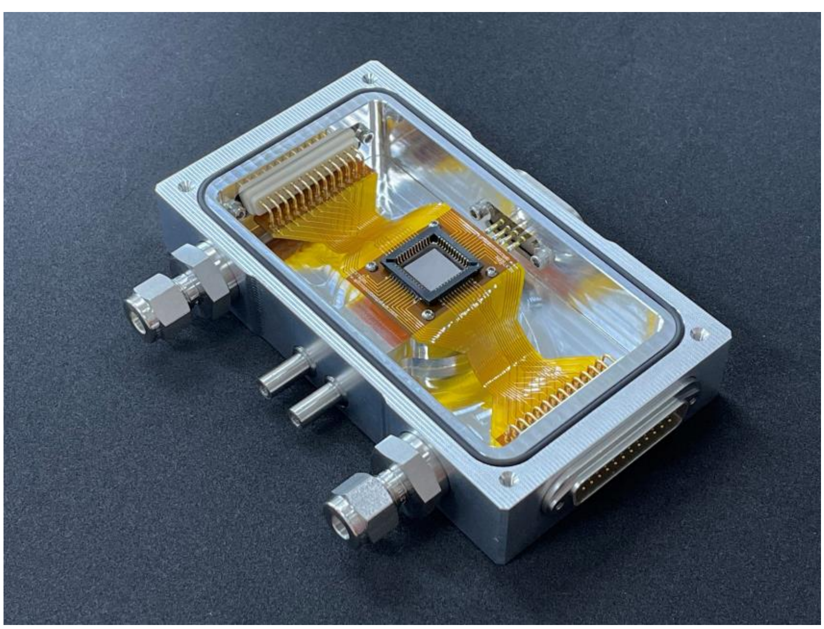
MPS-PT LLCC : -40℃ ~ 150℃
MPS-LN2 LLCC : 80K ~ 373K



Micro Probe System for LCC Chip

MPS-PT LLCC : -40℃ ~ 150℃





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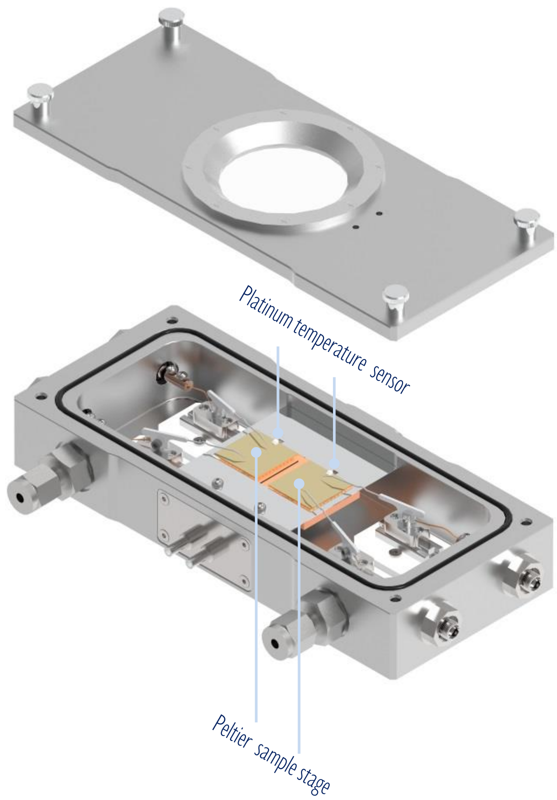
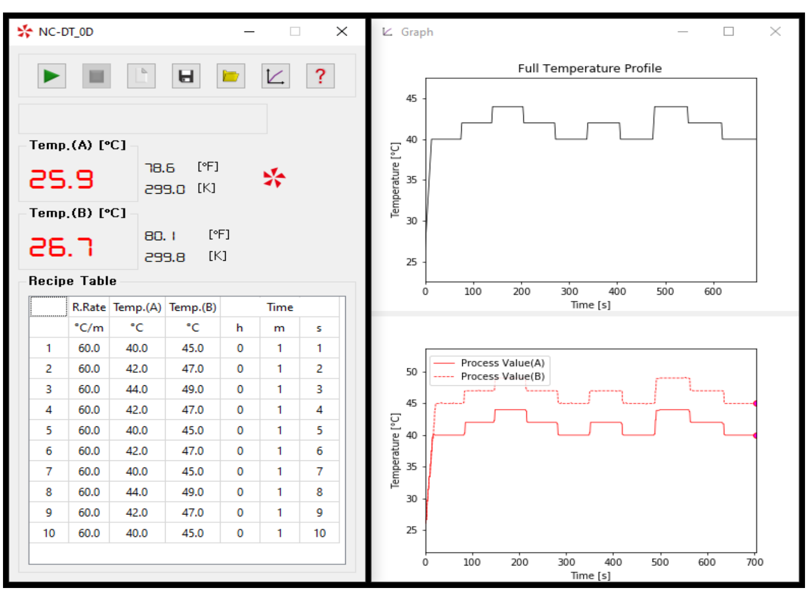
Dual Peltier Stages for Thermoelectric Devices





	R.Rate	Temp.(A)	Temp.(B)	Time		
	°C/m	°C	°C	h	m	s
1	60.0	40.0	45.0	0	1	1
2	60.0	42.0	47.0	0	1	2
3	60.0	44.0	49.0	0	1	3
4	60.0	42.0	47.0	0	1	4
5	60.0	40.0	45.0	0	1	5
6	60.0	42.0	47.0	0	1	6
7	60.0	40.0	45.0	0	1	7
8	60.0	44.0	49.0	0	1	8
9	60.0	42.0	47.0	0	1	9
10	60.0	40.0	45.0	0	1	10

Piezo-Driven Positioner

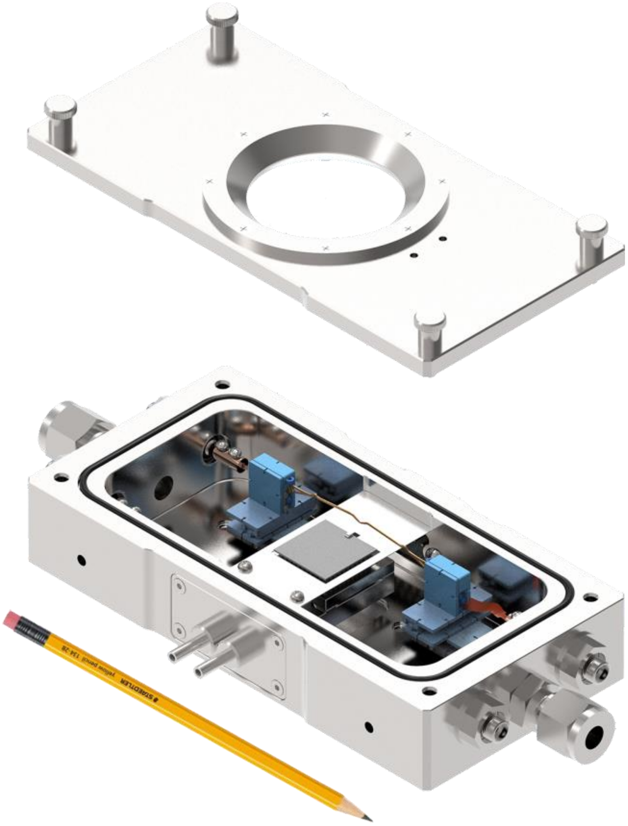
When stability and resolution are of the utmost importance, the Piezo-Driven positioner provides the perfect solution. Positioners are ultra-compact and based on slides with linear ball bearings. They are well-suited for micro-positioning systems, where space is the top priority.

Resolution : 50 nm

Force : 1 N(100 g)

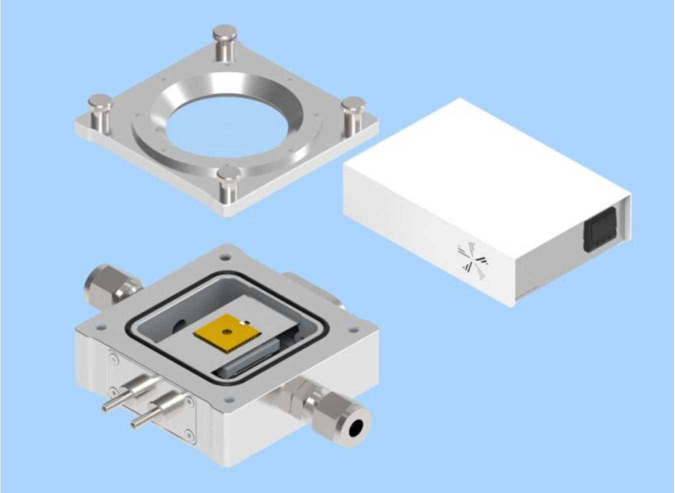
Travel(X, Y) : 11 mm

Travel(Z) : 4.5 mm



Micro optical Chamber (MOC)

MOC is miniature optical chamber (MOC) for optical measurements



- Low weight (300 g), small volume (< 30cc), low profile (24.5mm)

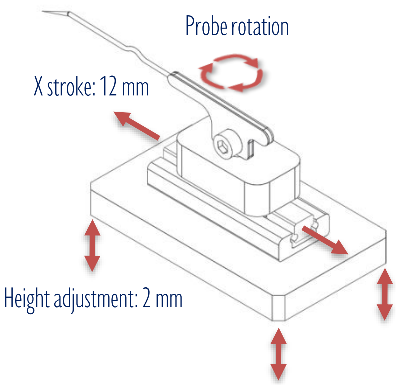
- Focal distance sample stage to top of window : ~ 3mm

- 5 versions depending on various temperature ranges
  1) -40 ℃ ~ +200 ℃ (Peltier type, MOC-PT)
  2) -40 ℃ ~ +170 ℃ (Peltier type, MOC-PTH)
  3) RT ~ +450 ℃ (Ceramic Heater type, MOC-CHL)
  4) RT ~ +750 ℃ (Ceramic Heater type, MOC-CHH)
  5) 80 ~ 373 K (Liquid Nitrogen type, MOC-LN2)

Manual Probe

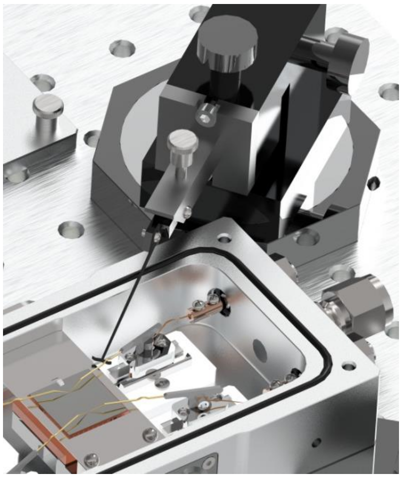
Quick & Easy

A unique probe module is only 30x20x20 mm. A stable contact is possible even on a 20x20 μm contact pad. As the probe module has a very flexible motion, it smoothly follows the displacement of the contact point caused by thermal expansion and maintains a stable contact.



see video at: https://youtu.be/Ikb9RtfGxFs

Precise Probing Arm



Precise probing arm is an accessory to support precise and fine adjustment with an external micro-positioner when the size of the contact pad is small.

Probe Tips

Probe type	Tip dia.	Material	Plate	Recommended models	Remark
Inconel probe 	300 μm	Inconel	Au	MPS-PT / PTH MPS-LN2	Max. operating Temp. : 200 °C * Strong sample fixation
Tungsten probe 	50 μm 100 μm	W	Rh or none	MPS-PT / PTH MPS-LN2 MPS-CHL	Max. operating Temp. : 450 °C (Rh plated) : 200 °C (not plated) * Small tip size
Rh wire probe 	250 μm 500 μm	Rh	Rh bulk wire	MPS-CHL MPS-CHH MPS-CHU	Max. operating Temp. : 750 °C : 1000 °C * Great durability at high temperature

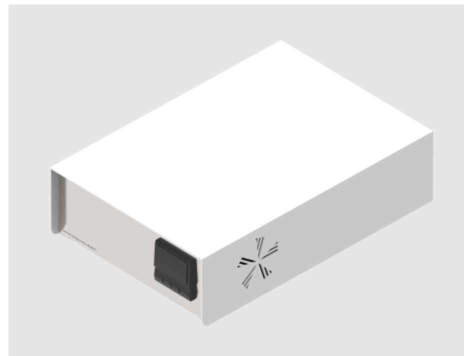
* The 50 &100 μm tungsten probes can be selected when the contact pad is small. For more precise probing, it is recommended to use with optional Precise probing arm.
* The larger tip size is, the better sample clamping force and durability are.
* Please refer to the recommended models in the above table for probe selection.
* All probes have spring structure inside and/or outside the probe module. It never loses contact stability in gas flow and scanning experiments. It is a great advantage that the contact does not become unstable even if there is movement due to thermal expansion and vibration.

Temperature Control Hardware and Software

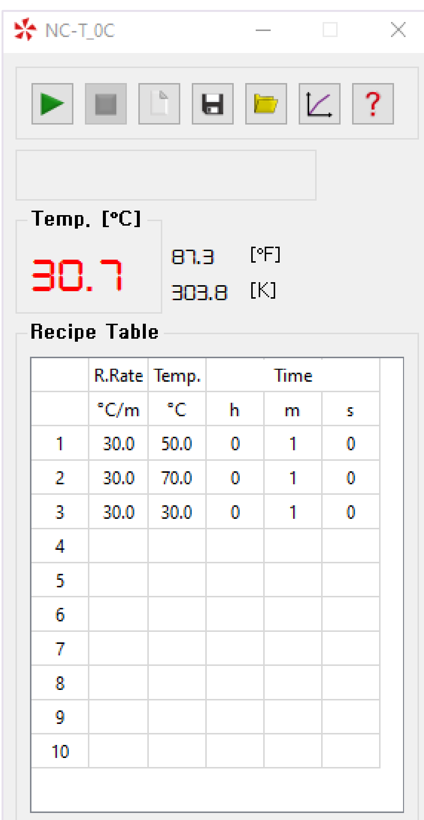
Hardware

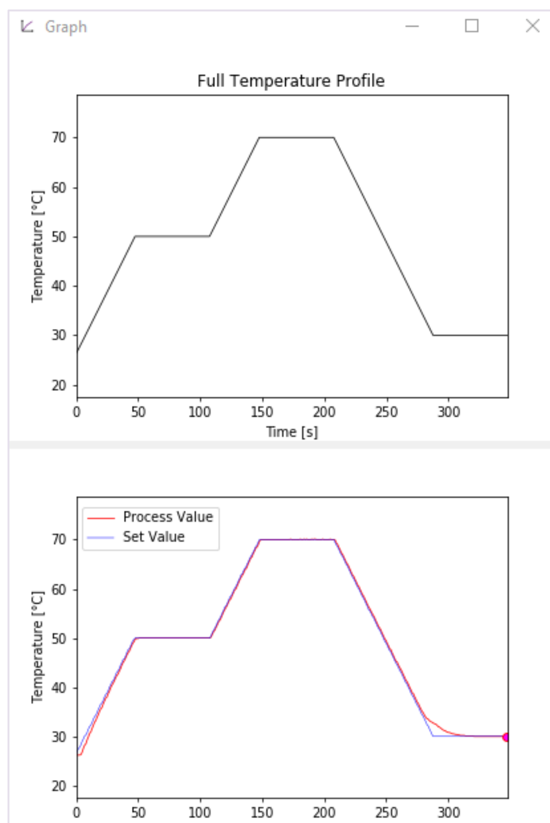
PID temperature controller

Programmable temperature profile



Software





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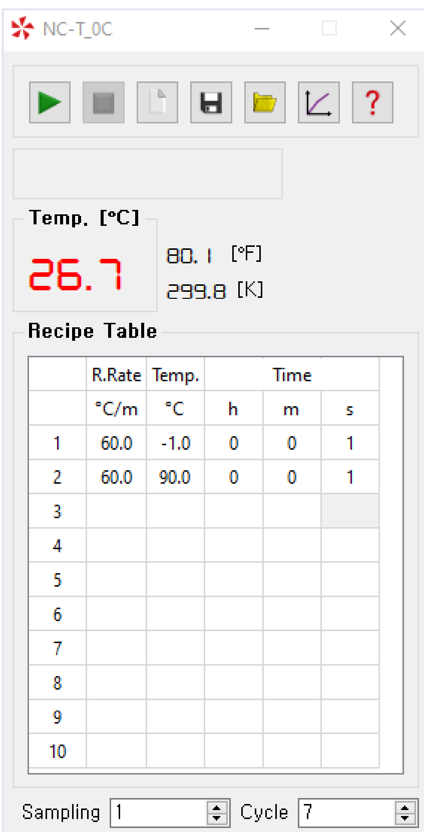
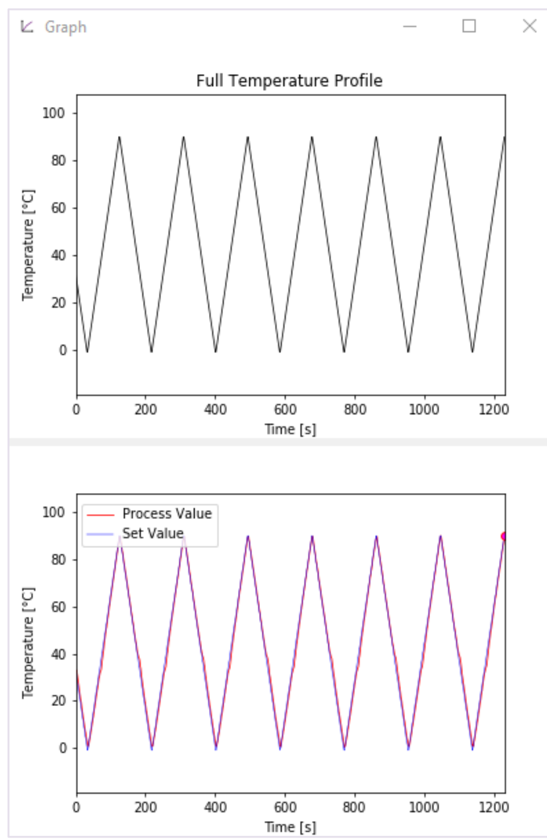
Temperature Control Hardware and Software

Software (Temperature cycle test)

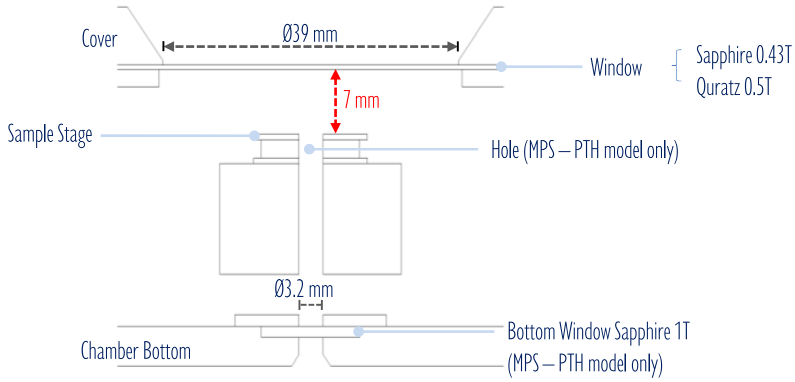
Temperature cycle test can be performed accurately with a Peltier type Micro Probe System (model: MPS-PT or MPS-PTH).



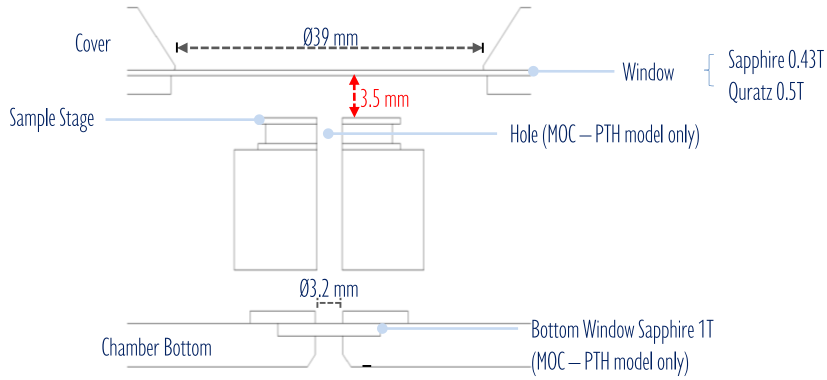


Working Distance

MPS (Micro Probe System)

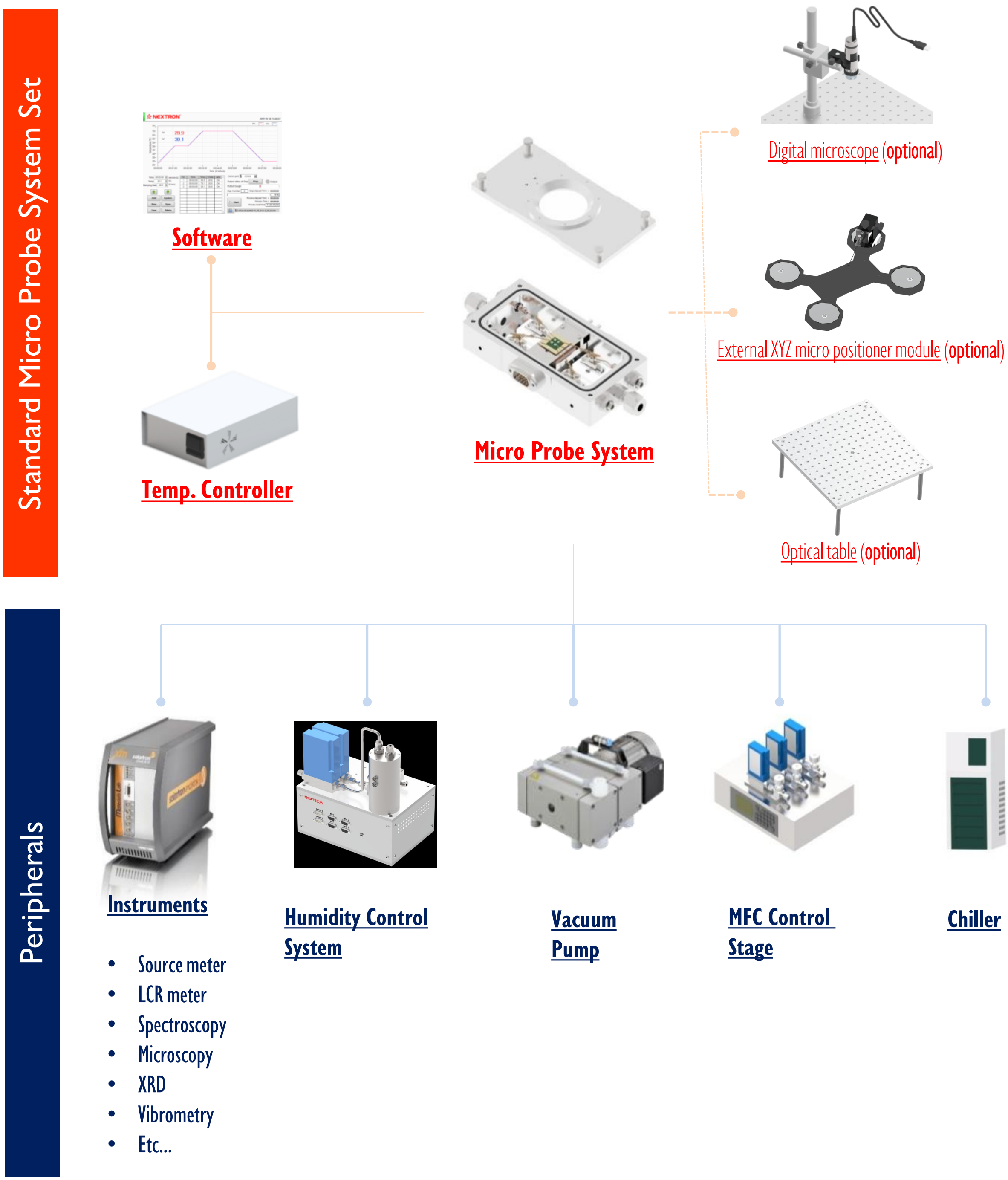


MOC (Micro Optical Chamber)



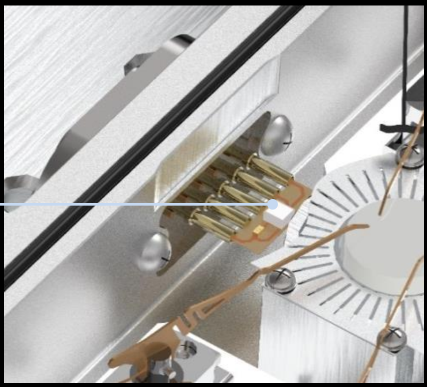
simplified

System Configuration



Precision Humidity Control System

Humidity sensor can be optionally installed inside the all chambers of Micro Probe Station.



The Precision Humidity Control System consists of a two-channel MFC, DI water bubbling bath and humidity control software.

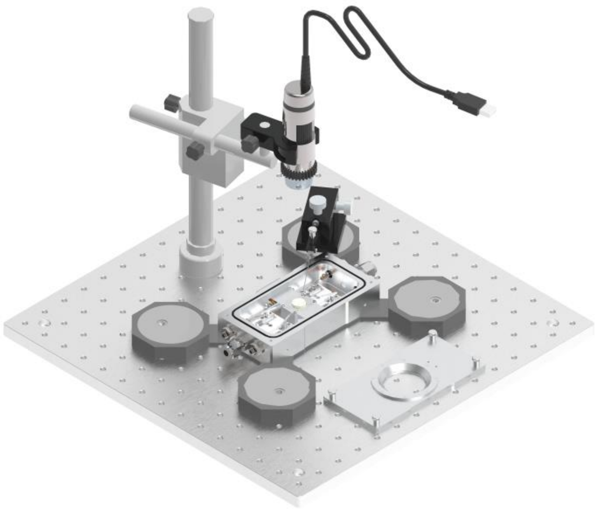
Precise control of relative humidity can be quickly achieved PID control method.

Humidity Control Specification

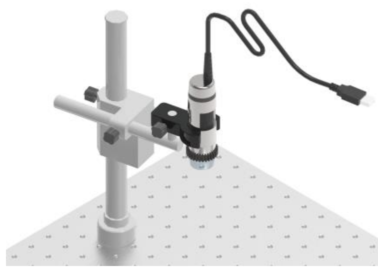
Typical RH Accuracy (%RH)	RH Resolution (%RH)	Normal Ramp Speed (%RH / min.)	DI water bath volume (cc)
2 (@0-99%RH)	0.01	10	500

Fully calibrated, linearized, and temperature compensated output.

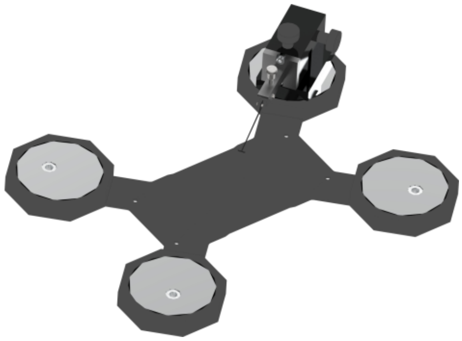
Optical Breadboard for Micro Probe System



350 x 350 mm breadboard have a light weight (only 2.3 kg) and can be conveniently mounted with options such as digital microscopes and external XYZ micro positioner module.



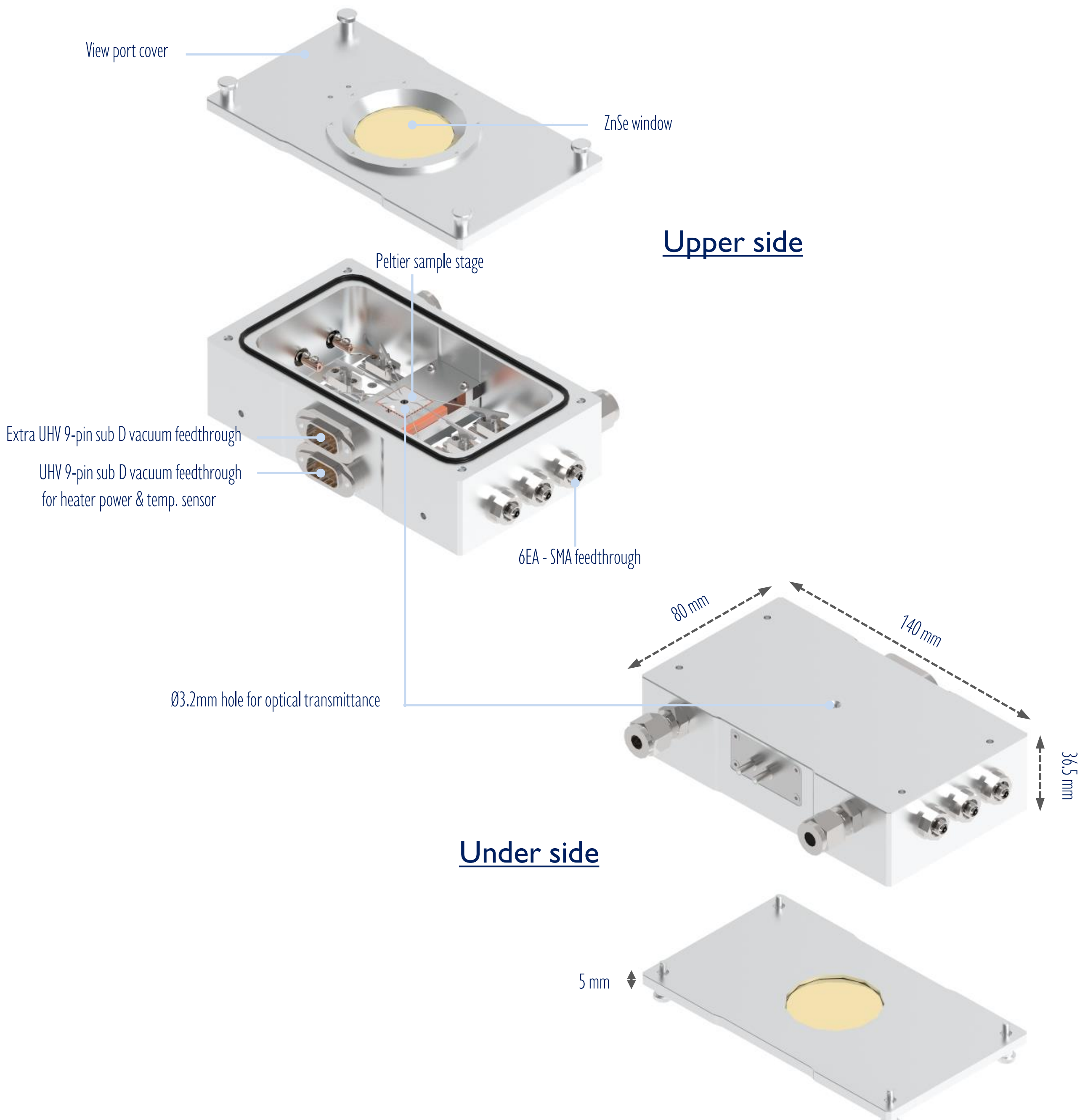
Digital microscope (optional)



External XYZ micro positioner module (optional)

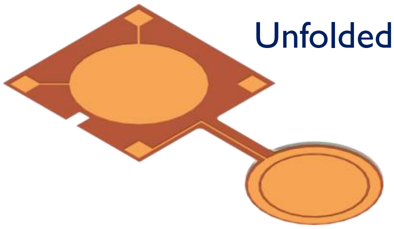
Optical table (optional)

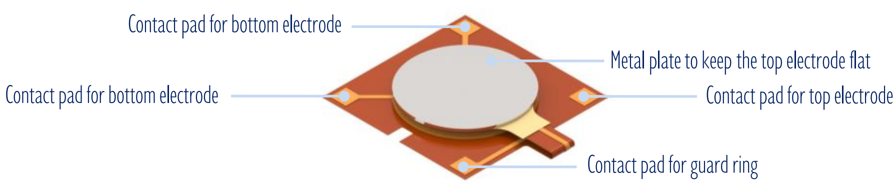
ZnSe Window for IR Transmittance

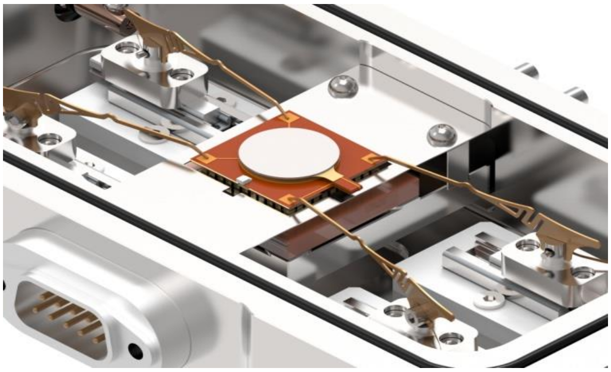


Polymer Capacitance Measurement Fixture

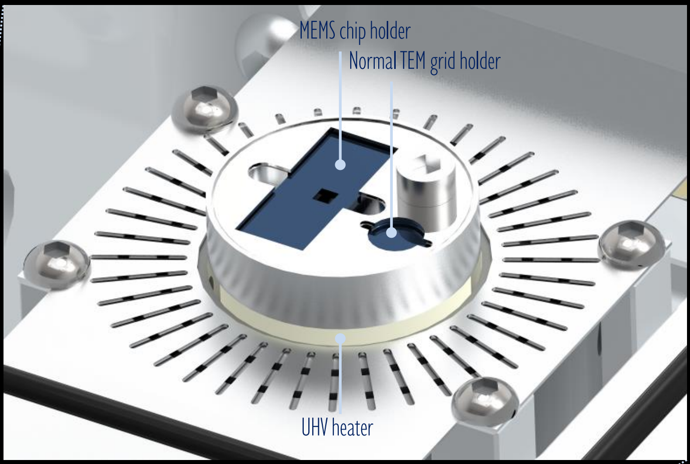
It is useful to measure the electric property of a sample in gel-state or a polymer film.
Especially, the reliability of the measurement can be improved because it can give a constant contact-pressure by one probe module.
In addition, a uniform electric field by a guard ring improves the precision of the measurement.
It makes the measurement convenient to use well-defined top electrode.
* This is not an off-the-shelf product and is supplied through customized manufacturing by the consultation with customers.

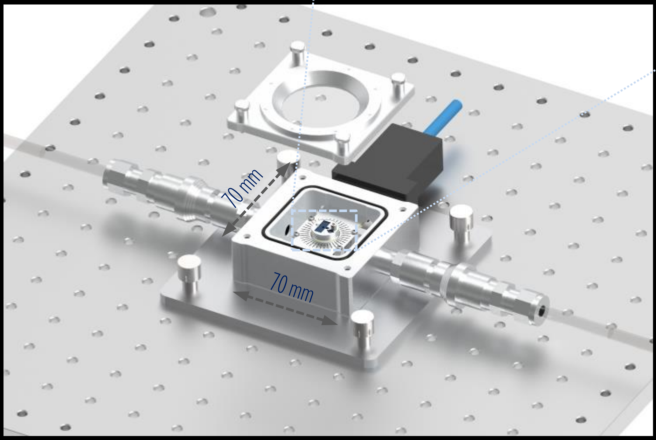






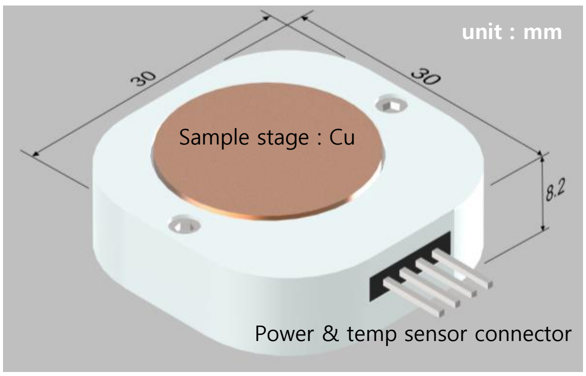
TEM Sample Cleaning / Gas Reaction Chamber

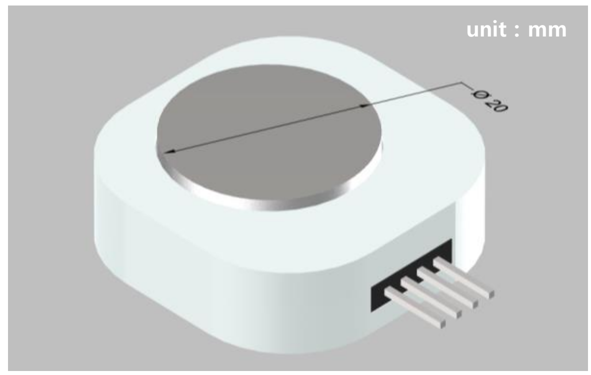




Maximum Temperature	Base Pressure	Max. Heating / Cooling Rate
750 °C	6.7×10^{-6} mb	1 °C / sec

AFM Cooling and Heating Stage



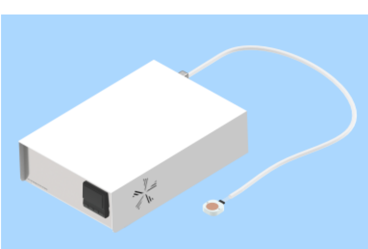


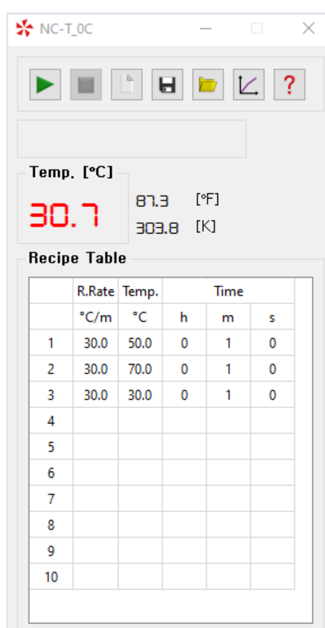
Upper side

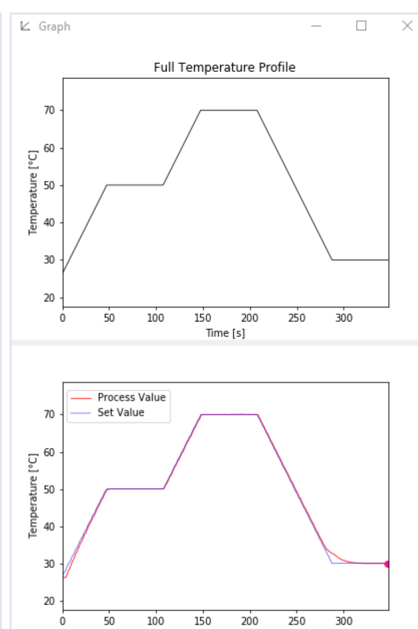
Under side

Specification

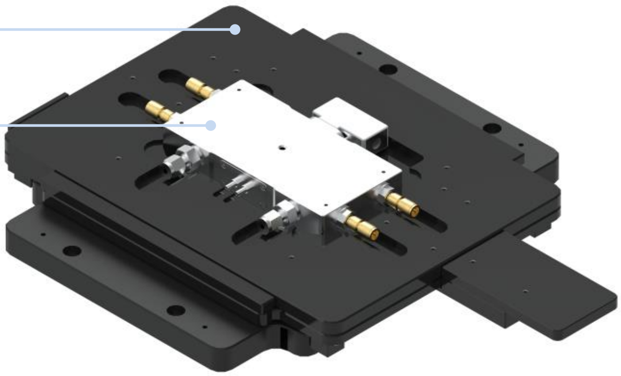
- Temperature range : 20 ℃ ~ 200 ℃
- Maximum heating / cooling rate : 1 ℃ / sec
- Accuracy : ± 0.1 ℃

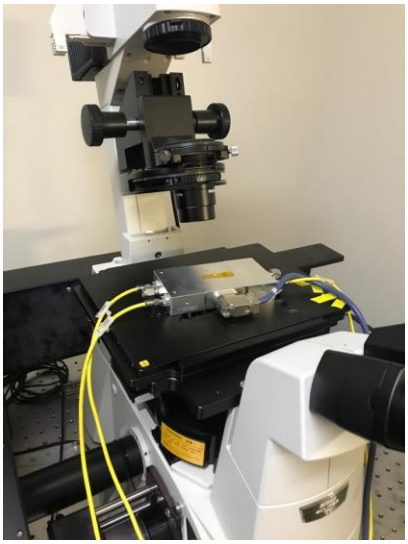






Stage for Eclipse Ti-U Inverted Microscopes





Upper side

Under side

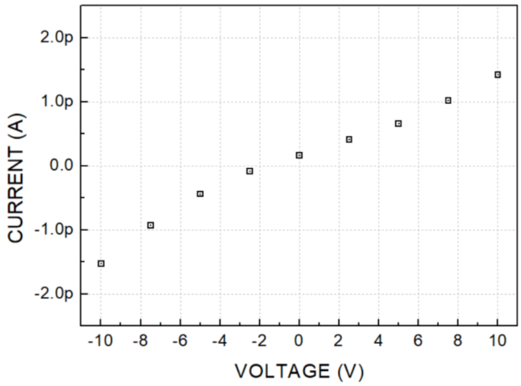
Electric Characteristics

DC

- Leakage current: **100pA**
  standard SMA-BNC coaxial cable
- Leakage current: **100fA**
  optional SMA-TNC triaxial cable
  tested by using Keithley 4200-SCS Semiconductor Characterization System
- Maximum DC voltage / current : **500VDC / 1000mA**

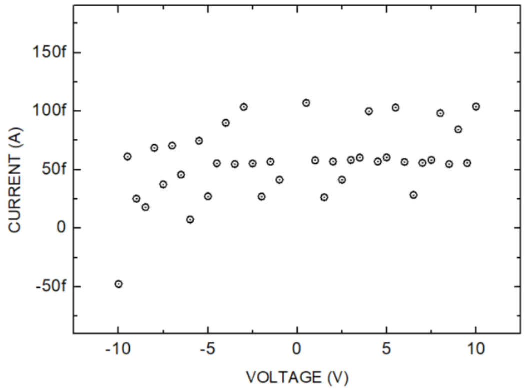
RF

- Maximum frequency : **30 MHz**
- When it is corrected (de-embedding) with Lw and Cp (wire inductance and probe capacitance), maximum frequency can be expanded up to **300 MHz.**
- Measured by using Agilent E5071C network analyzer



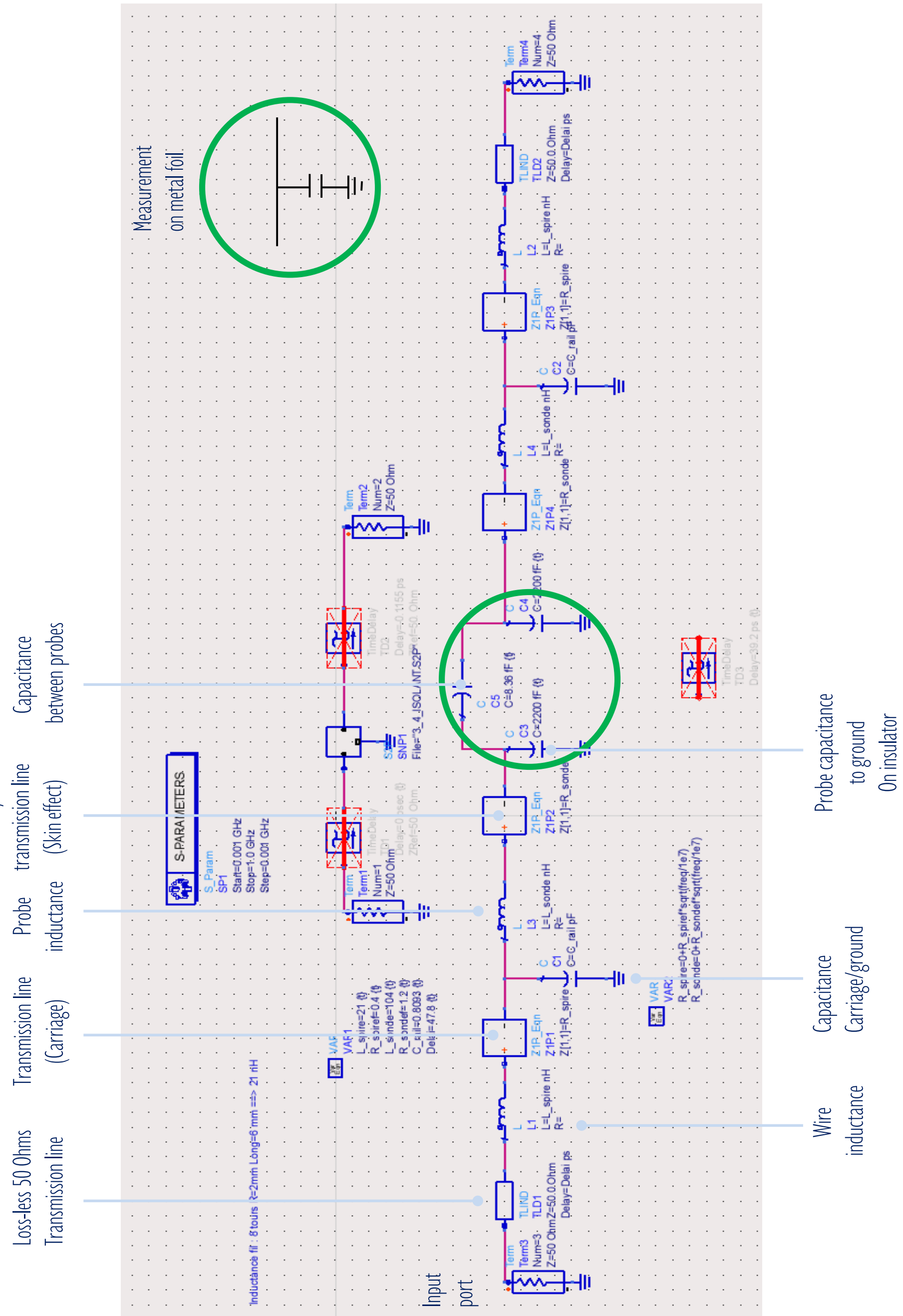
Low current measurement of ~ 10^{13} ohm resistor

Off-current noise test



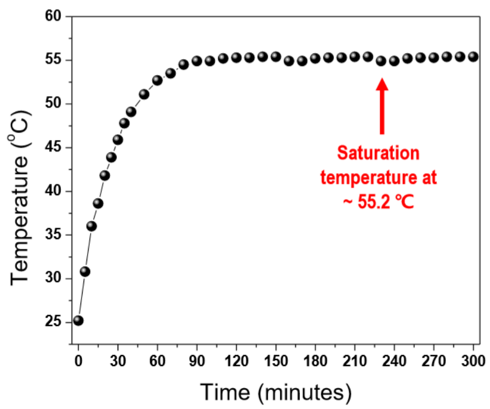
Electric Characteristics : RF

Equivalent Circuit of Micro Probe System for RF Measurements



Data

Thermal isolation (model : MPS-CH)

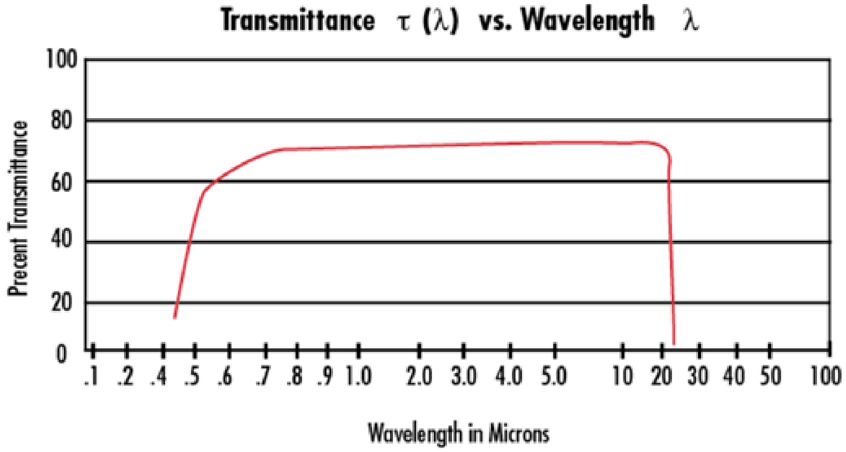


✓ **Experiment conditions**

Laboratory temperature	19 ~ 21 ℃
Temperature of sample stage	450 ℃
Ramping rate of sample stage	1 ℃ per second
Chamber condition	Thermally floated, with cover
Chamber pressure	1 atm, air

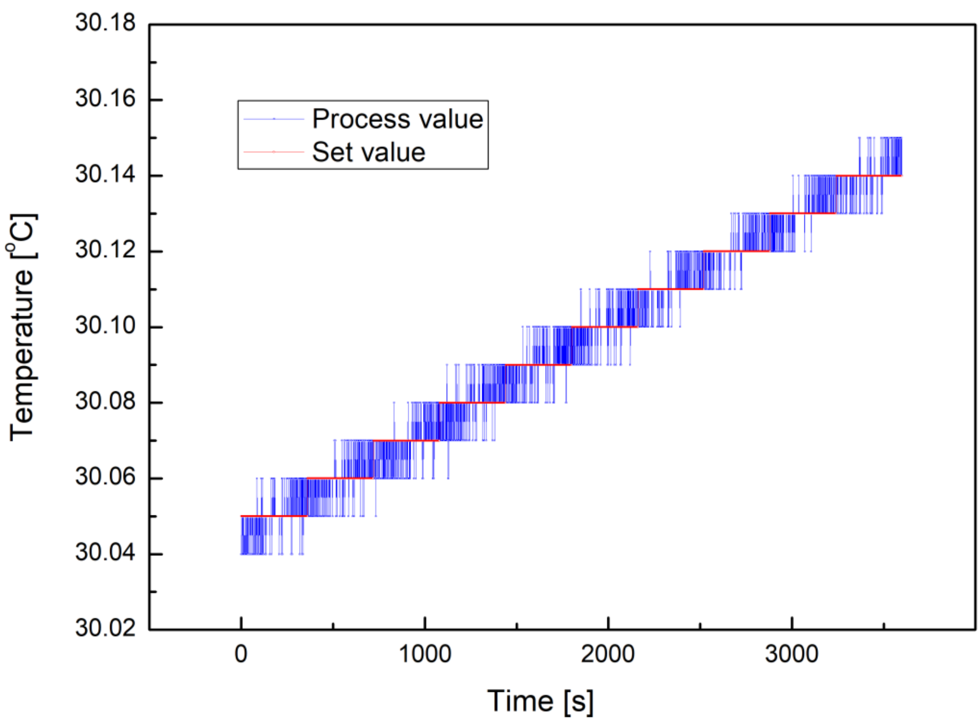
- It has been measured that the temperature at the bottom-center of the chamber, which is the nearest spot to the heater.

Transmittance of uncoated ZnSe window



Data

Temperature resolution and accuracy (model : MPS-PT)



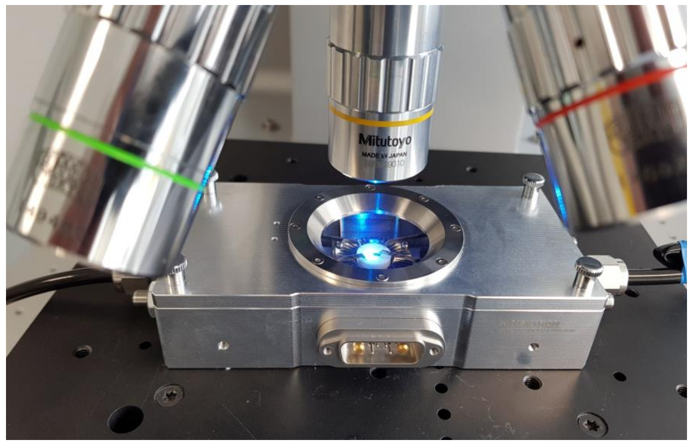
- Temperature setting conditions : 0.1°C heating condition from 30.04 °C to 30.14 °C for 1 hour
- Temperature resolution : 0.01°C
- Temperature accuracy : ± 0.01°C

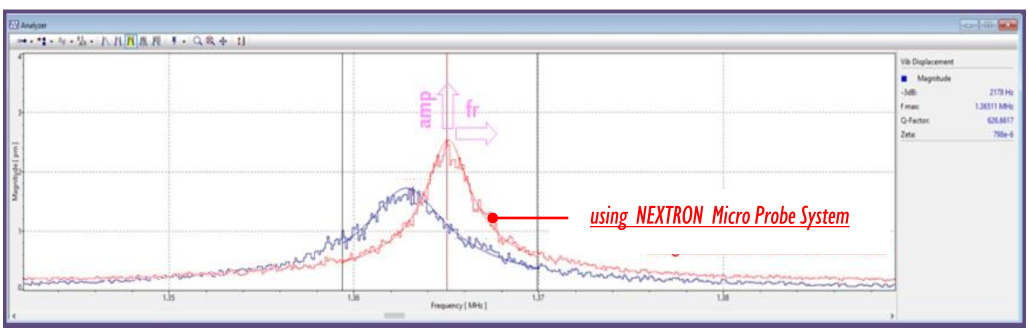
Applications

- Photovoltaic cells' and thermoelectric materials' characterization
- Transistors, diodes, LED, ... testing
- Bulk and thin film materials' thermal conductivity measurements (3 ω Method)
- Phase transition materials' electrical/optical characterization (metal oxides, Memristor,. . .)
- Characterization of MEMS/NEMS mechanical and electro- mechanical resonators (reference clocks, mass sensors)
- Characterization of micro-coils and micro-antenna for inductive sensors (Impedance spectroscopy of biological tissues, In vivo RMN)
- Capacitive, resistive & resonant micro/nano sensors testing
- Etc...

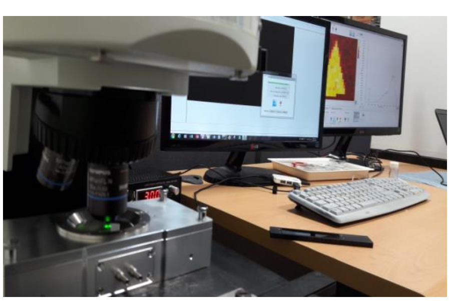
Applications

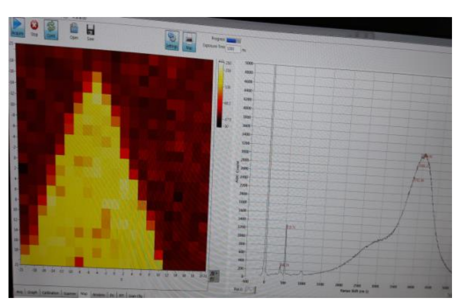
Example: Thermal resonant frequency measurement





Example: Raman mapping



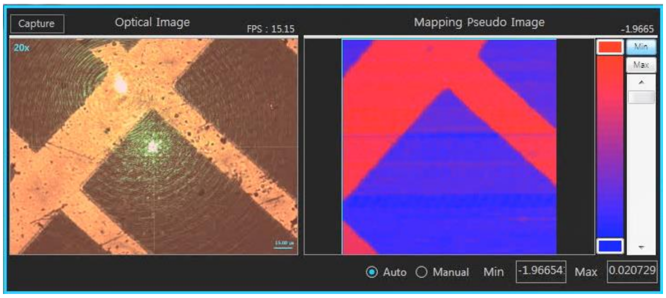


2D Molybdenum disulfide (MoS2)

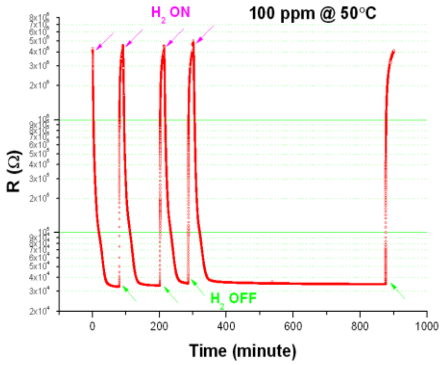
compatible

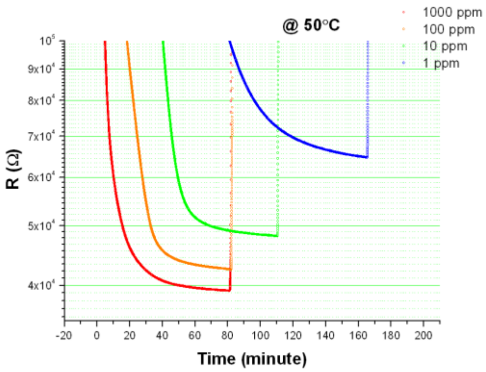
Applications

Example: Photo current mapping



Example: Resistive gas sensor characterization



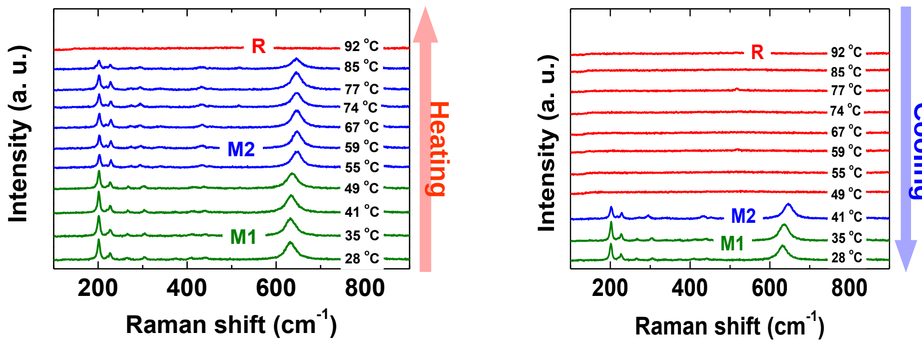


Measured while purging hydrogen and nitrogen mixed gas without using vacuum pump
Sample: Palladium coated Zinc oxide(ZnO/Al2O3) nanowire for hydrogen gas sensing

Applications

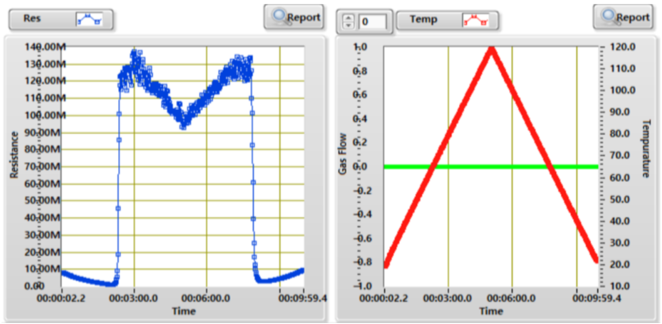
Example: Raman spectrometry

Vanadium dioxide(VO_2) nanowire
Study of phase transition by temperature



Example: MIT (Metal-Insulator Transition)

Single crystalline VO2 nanobeams
Study of MIT (Metal-Insulator Transition)



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NANO LETTERS

Communication

Ultrafast infrared photoresponse from heavily hydrogen-doped VO2 single crystalline nanoparticles

Min-Woo Kim, Yong-Ryun Jo, Changhoon Lee, Ji Hoon Shim, and Bong-Joong Kim

Nano Lett., **Just Accepted Manuscript** • DOI: 10.1021/acs.nanolett.0c00358 • Publication Date (Web): 28 Feb 2020

NANO LETTERS

Letter

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Dynamic Tuning of Gap Plasmon Resonances Using a Solid-State Electrochromic Device

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Effect of seed layers and rapid thermal annealing on the temperature coefficient of resistance of Ni—Cr thin films

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Publications

ACS APPLIED MATERIALS & INTERFACES
Research Article
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www.acsami.org

Low-Voltage, CMOS-Free Synaptic Memory Based on Li_xTiO_2 Redox Transistors

Yiyang Li,[*,†] Elliot J. Fuller,[*,†] Shiva Asapu,[‡] Sapan Agarwal,[†] Tomochika Kurita,[†,§] J. Joshua Yang,[‡] and A. Alec Talin[*,†]

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Applied Surface Science 455 (2018) 1185–1191
Contents lists available at ScienceDirect
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Formation of a core-shell-like vanadium dioxide nanobeam via reduction and surface oxidation and its metal-insulator phase transition behavior

Min-Woo Kim[a,b], Tae-Sung Bae[a], Woong-Ki Hong[a,*]

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[b] School of Materials Science and Engineering, Gwangju Institute of Science and Technology, Gwangju 500-712, South Korea

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Highly Scalable Synthesis of MoS_2 Thin Films with Precise Thickness Control via Polymer-Assisted Deposition

Heeseung Yang,[†,#] Anupam Giri,[‡,#] Sungmin Moon,[‡] Sangbae Shin,[‡] Jae-Min Myoung,[*,†] and Unyong Jeong[*,‡]

[†]Department of Materials Science Engineering, Yonsei University, 134 Shinchon-dong, Seoul, Korea
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Publications

Journal of Alloys and Compounds 720 (2017) 445–450

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Journal of Alloys and Compounds

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Voltage sweep direction-dependent metal-insulator transition in a single-crystalline VO_2 nanobeam embedded in a insulating layer

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Hyun Jo [a, b], Min-Woo Kim [a, b], Woong-Ki Hong [a, *]

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[b] School of Materials Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, 61005, Republic of Korea

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Metastable state-induced consecutive step-like negative differential resistance behaviors in single crystalline VO_2 nanobeams†

Jung Inn Sohn,*[a,b] Seung Nam Cha, [a] Seung Bae Son,[c] Jong Min Kim,[a]
Mark E. Welland[b] and Woong-Ki Hong *[c]

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Gas molecule sensing of van der Waals tunnel field effect transistors†

Hong Kyw Choi,‡[a] Jaesung Park,‡[b] Nojoon Myoung, ‡[c,d] Ho-Jong Kim,[e]
Jin Sik Choi,[f] Young Kyu Choi,[a] Chi-Young Hwang,[a] Jin Tae Kim, [a] Serin Park,[a]
Yoonsik Yi,[a] Soo Kyung Chang,[e] Hee Chul Park, [d] Chanyong Hwang,*[b]
Choon-Gi Choi*[a] and Young-Jun Yu *[g]

Publications

NANO LETTERS

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Communication

Real-time structural and electrical characterization of metal-insulator transition in strain-modulated single-phase VO2 wires with controlled diameters

Min-Woo Kim, Sung Soo Ha, Ok-Kyun Seo, Do Young Noh, and Bong-Joong Kim

Nano Lett., **Just Accepted Manuscript** • DOI: 10.1021/acs.nanolett.6b00719 • Publication Date (Web): 02 Jun 2016

Video Link Sites

- https://youtu.be/BA_hKFB33vw : Micro Probe System 1
- https://youtu.be/-z6wTGVc558 : Micro Probe System 2
- https://youtu.be/lxByk5QD-ro : Micro Probe System 3
- https://youtu.be/3HgDsR5RQUM : Micro Probe System 4
- https://youtu.be/3qakZHBnP7E : Micro Probe System 5
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- https://youtu.be/3wmGngqIEOA : Micro Probe System 8
- https://youtu.be/juR4PJZyR44 : Micro Probe System 9
- https://youtu.be/epWANy4FkVE : Photocurrent mapping 1
- https://youtu.be/pKnMue6WcQs : Photocurrent mapping 2
- https://youtu.be/lg_Pd6c-F4U : Metal-Insulator transition

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