Bridge Technology

Representing

ECOPIA

HMS-5000, HMS-5300, & HMS-5500

Van der Pauw

Hall Effect Measurement System

Temperature dependent measurement within the following ranges:

HMS-5000: 80°K to 350°K
(NOT upgradable to add high-temp kit)

HMS-5300: 80°K to 350°K and/or Ambient to 573°K

HMS-5500: 80°K to 350°K and/or Ambient to 773°K

(HMS-5300 & HMS-5500 are upgradeable to add either high temp or low temp sample kit)

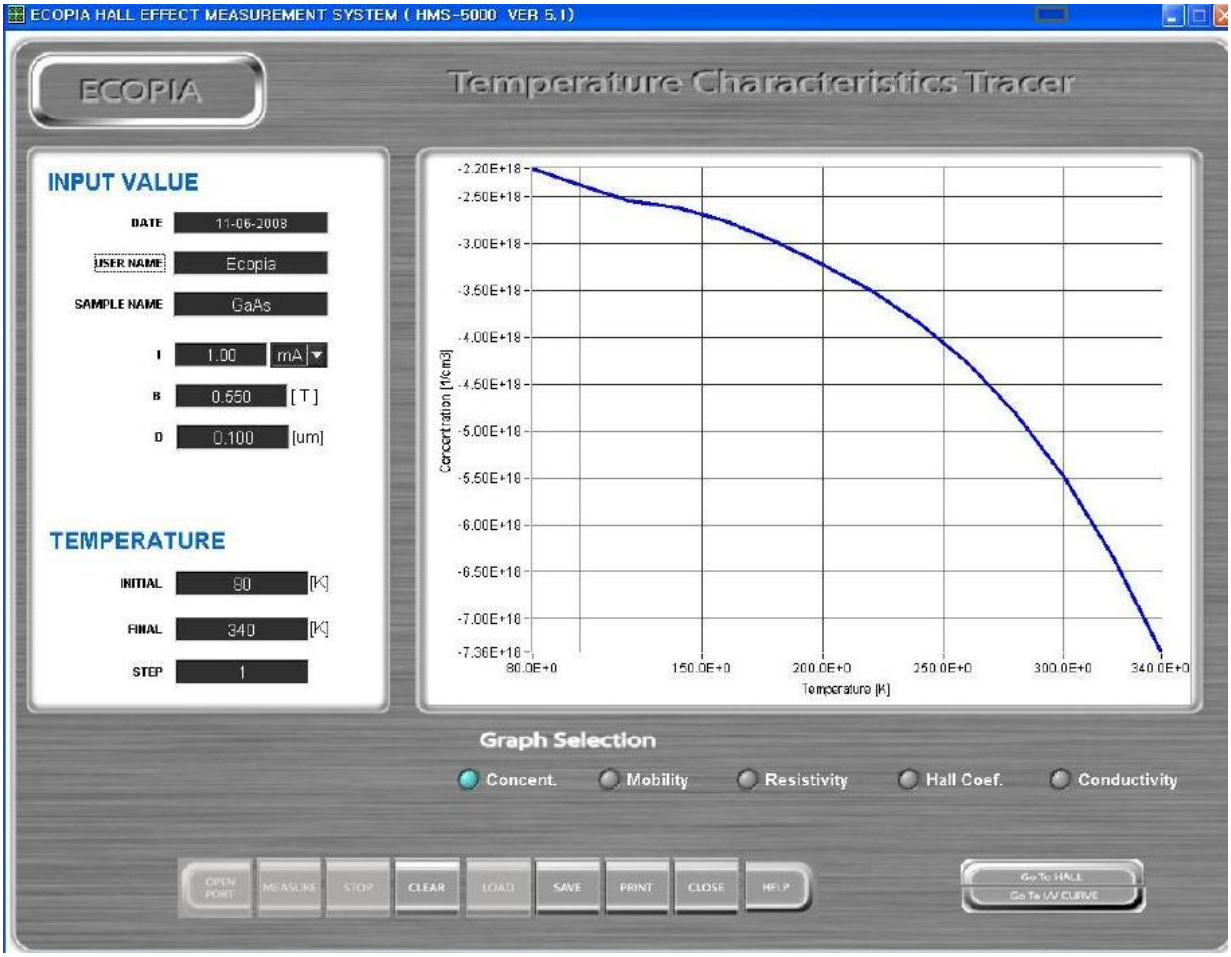
PC not included. Runs on MS Windows operating systems.

See page 7 for Photonic Hall Effect System

The HMS-5000, HMS-5300, and HMS-5500 Hall Effect Measurement Systems plot concentration versus temperature, mobility versus temperature, resistivity versus temperature, conductivity versus temperature, and Hall coefficient versus temperature. The systems provides the test results as tabular data as well as in graph form. The user defines the desired temperature steps within the temperature range, fills the two LN2 reservoirs if performing sub ambient testing, and then the system automatically applies and switches the input current, measures the voltages, changes temperature, and moves the magnets all without user intervention. Once the test is finished, the temperature dependent graphs and tabular data are ready for viewing. The magnet movement is motor controlled and automated, variable temperature capability, and powerful analysis software. The systems ramp to each user defined temperature, stabilize, makes the measurement (including moving the magnet automatically), and then plots the various temperature dependent material electrical properties.

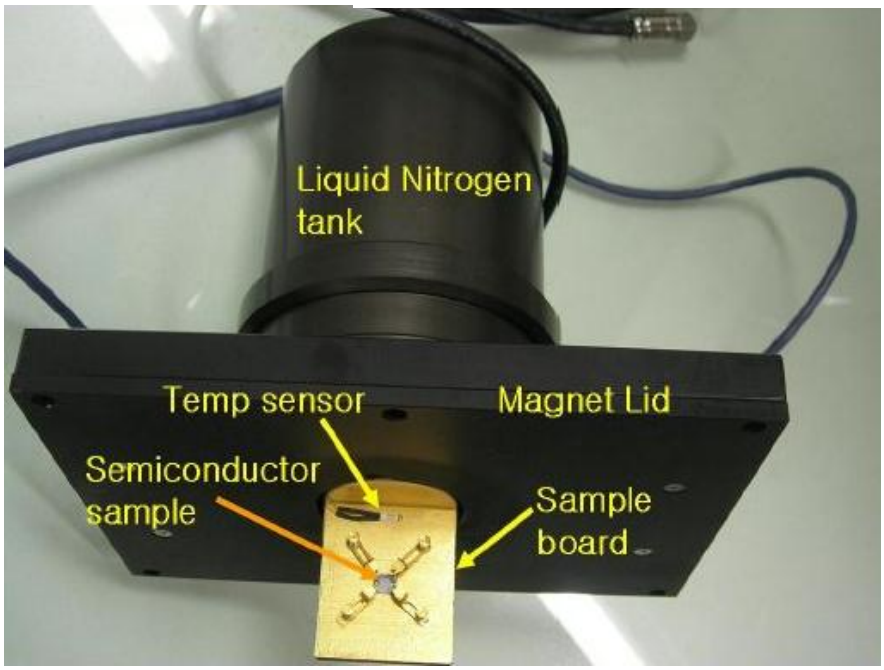
- **Sample size: 5 mm x 5mm up to 15m x 15mm**
- **Resistivity: 10^{-4} to 10^{7} (Ohms-cm)**
- **Magnet : Permanent magnet, 30 mm diameter**
- **Magnet Flux Density: 0.55T nominal +/-1% of marked value**
- **Mobility: (cm^2/Volt-sec) 1 ~ 10^{7}**
- **Concentration: (cm^{-3}): 10^{7} ~ 10^{21}**
- **Current Source: Range: 1nA-20mA Compliance: 12V**
- **Minimum Hall Voltage: 1µV**

Temperature Ranges: HMS-5000: 80K to 350K (only)
HMS-5300: 80°K to 350°K &/or 300°K to 573°K
HMS-5500: 80°K to 350°K &/or 300°K to 773°K

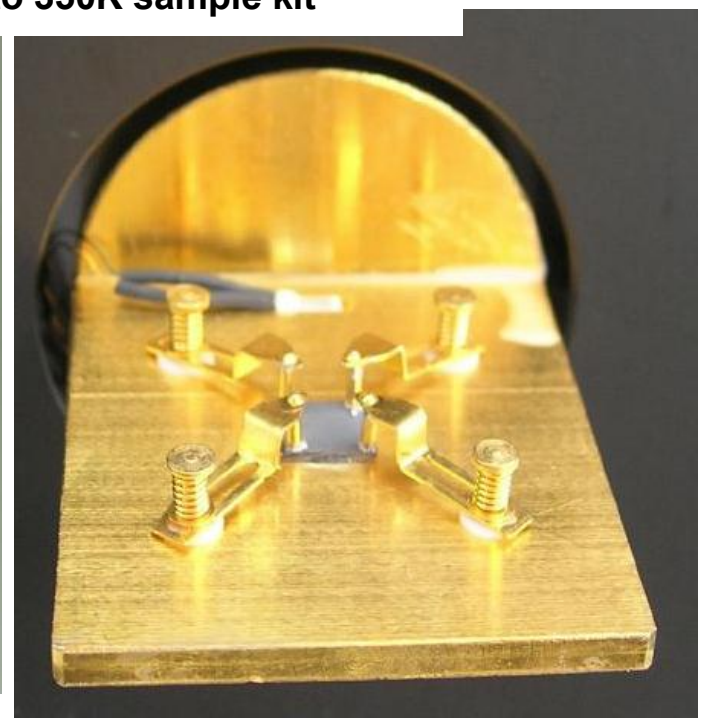


Software displaying carrier concentration versus temperature in range from 80K to 340K

Shown are parts for the 80K to 350K sample kit



Sample Mounting Fixture with upper cooling reservoir



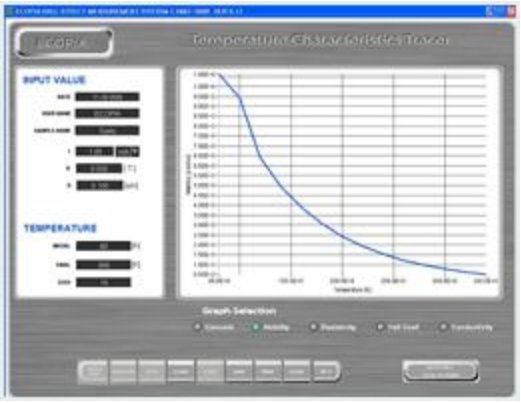
Sample Mounting Fixture

For best results, samples should be square in shape and can be from 5mm x 5mm up to 15mm x 15mm in size.

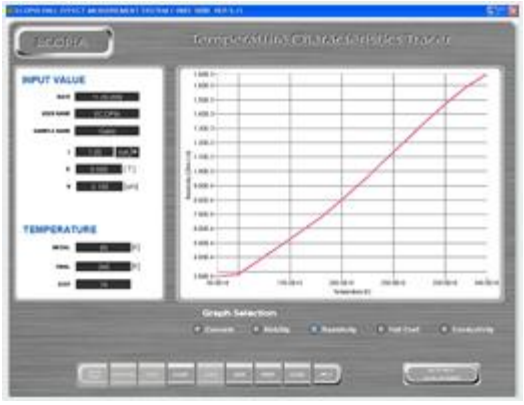
HMS-5000's Main Test Page

I-V, I-R graph per temp variation

Carrier concentration vs temp variation

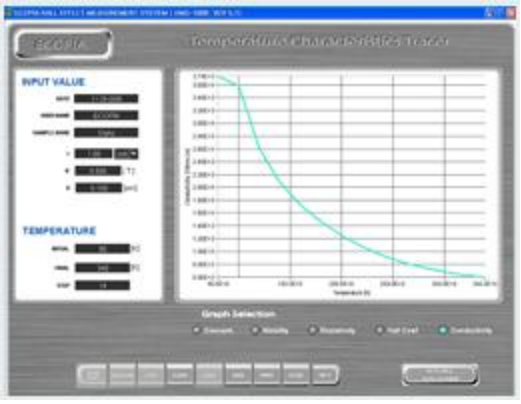


Carrier mobility vs temp variation



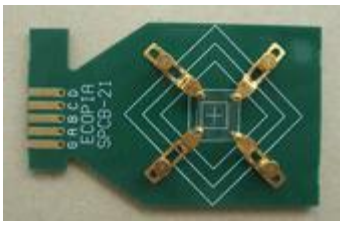
Resistivity vs temp variation

Hall Coefficient vs temp variation



Conductivity vs temp variation

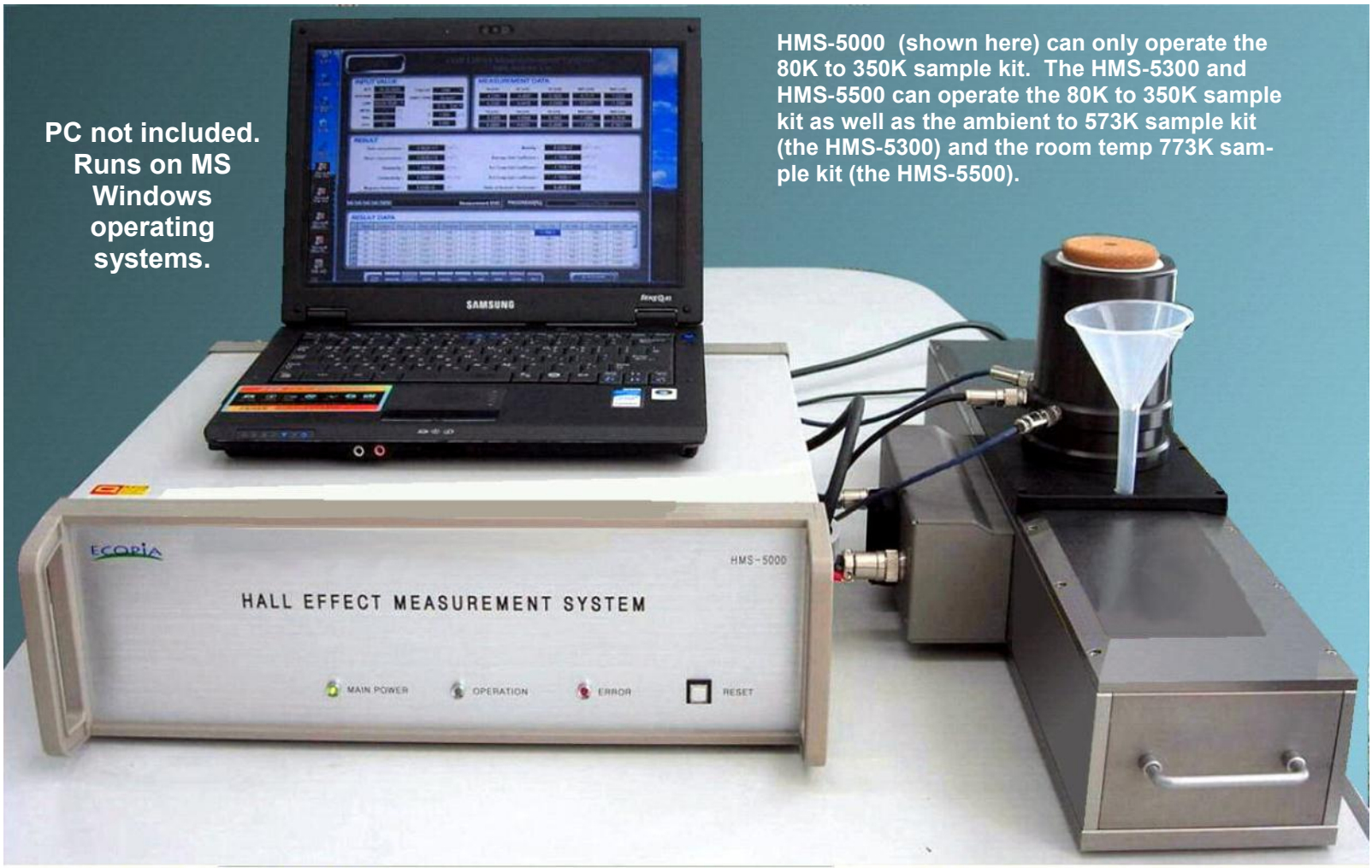
An optional room-temperature / LN_2 temperature sample kit lid with sample board is available as an option for the HMS-5000



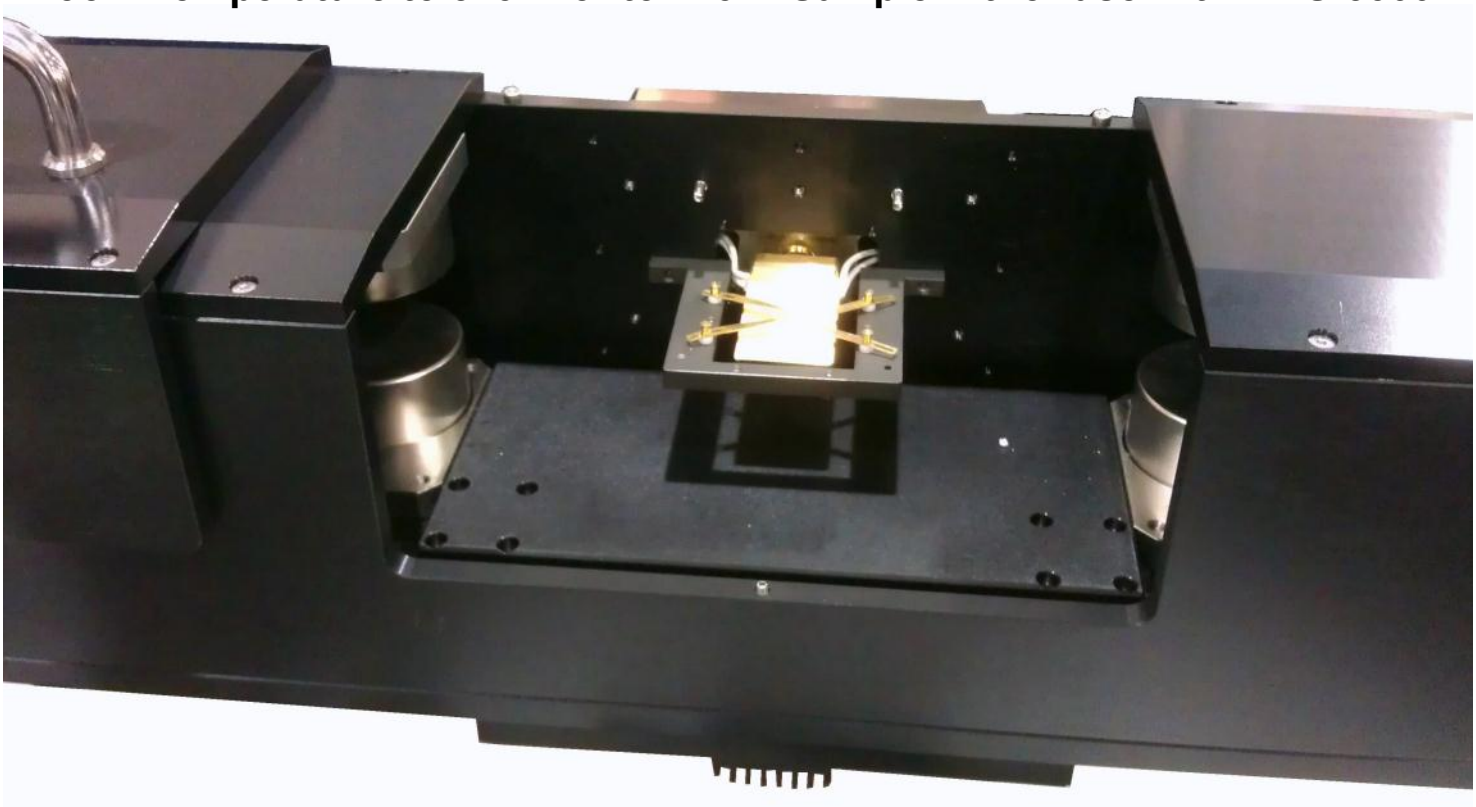
SPCB-21 spring mount board for use with HMS-5000 when equipped with the optional room-temperature / LN_2 temperature sample kit. For samples up to 20mm square.

PC not included. Runs on MS Windows operating systems.

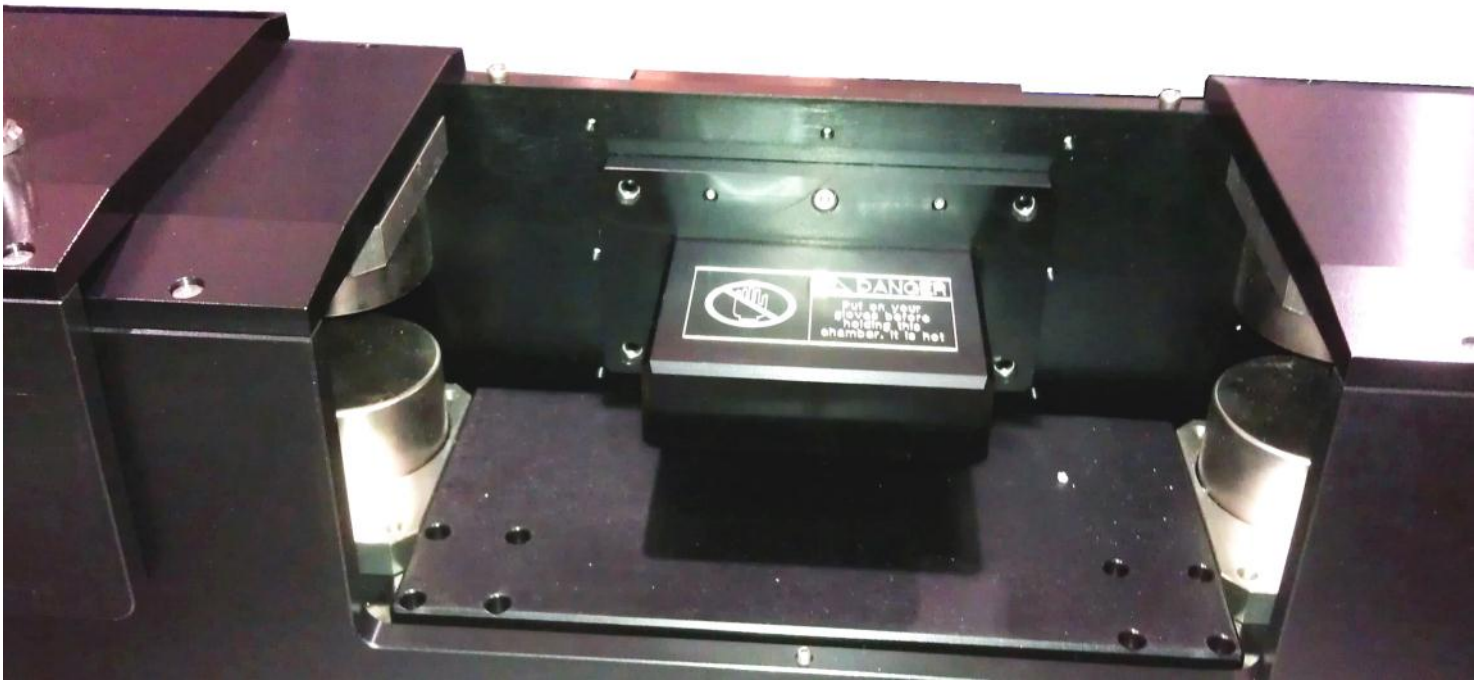
HMS-5000 (shown here) can only operate the 80K to 350K sample kit. The HMS-5300 and HMS-5500 can operate the 80K to 350K sample kit as well as the ambient to 573K sample kit (the HMS-5300) and the room temp 773K sample kit (the HMS-5500).



Room Temperature to 573°K or to 773°K Sample Kit for use with HMS-5300

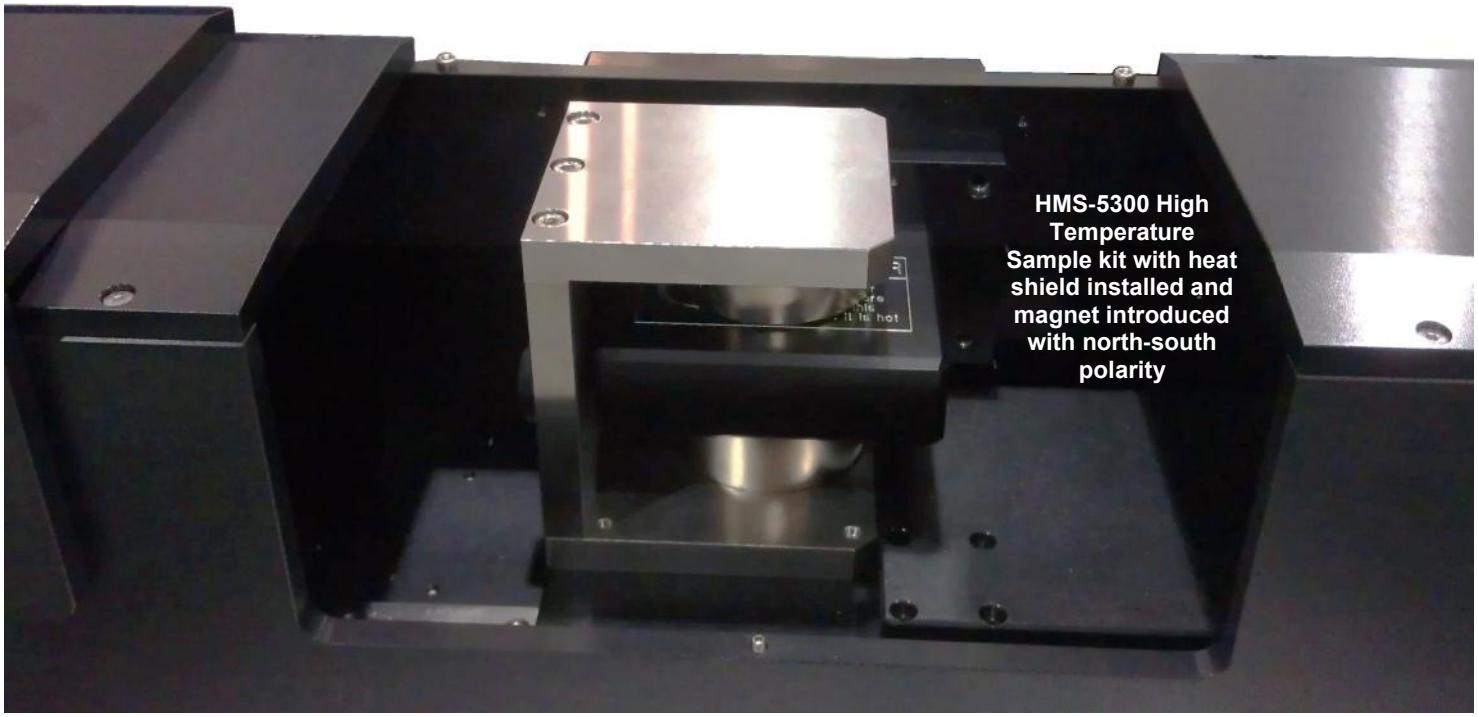


The HMS-5000 and HMS-5300 have two 0.55T magnet sets mounted on a ball bearing slide. A 0.55T magnet set is introduced by motor control from one direction, then with reversed polarity from the opposite direction. Shown above is the high temperature sample kit which is for use with the HMS-5300 only. The sample mounts horizontally onto the heater. Spring loaded probes make contact at four corners of the sample. The 80°K to 350°K sample kit mounts the sample vertically so that it can be submerged in liquid nitrogen.

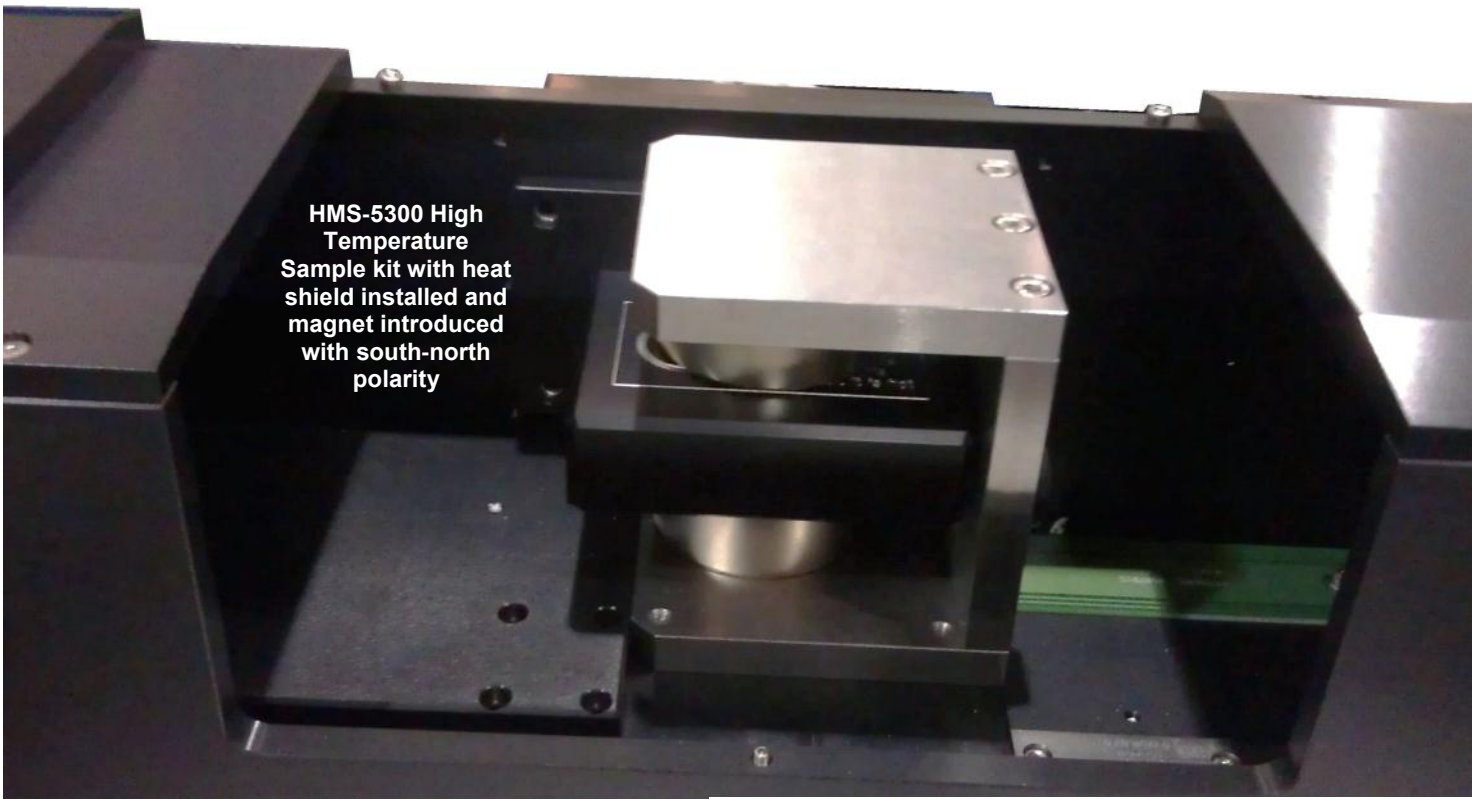


The heat shield is placed over the sample/heater assembly when measuring at high temperatures up to 573°K (300°C) or up to 773°K (500°C). Gas ports on the back of the sample kit allow purge gas to flow during high temperature testing to prevent oxidation of the sample holder.

Sample kit with ambient to 573°K (HMS-5300) or ambient to 773°K (HMS-5500). Heat shield allows inert gas to be introduced to prevent oxidation of sample holder/heater. Two magnet sets on motorized ball bearing slide, shown below with left side magnet set applied.



HMS-5300 High Temperature Sample kit with heat shield installed and magnet introduced with north-south polarity



HMS-5300 High Temperature Sample kit with heat shield installed and magnet introduced with south-north polarity

For further information, please contact:

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Photonic Hall Effect Measurement System
(HMS7000 + AMP55TP)

INTRODUCTION (Classical Hall effect)

Classic hall effect measurement system is to read voltage difference made between both diagonal sides, when flowing current and applying magnet field strength, in perpendicular to flowing current direction.

INTRODUCTION (Photonic Hall effect)

Photonic hall effect measurement is to read various electrical properties by illuminating light of "various range of wavelength" on the sample, in addition to flowing current and applying magnet field strength.

It is great to see "RGB (Red, Green, Blue), Light intensity vs carrier density, carrier mobility, resistivity, hall coefficient "

THEORY OF OPERATION

Hall Effect measurement 's theoretical basis is Lorentz Force and Van der pauw technique.

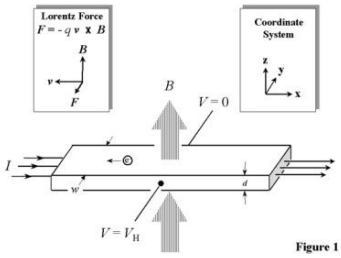


Figure 1

* Van der pauw technique

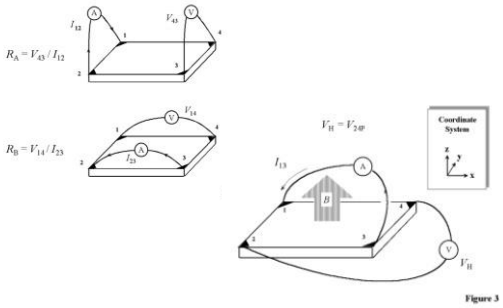
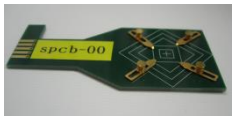


Figure 3

APPLICATION

It gives optical parameters vs electrical parameters to researchers who are making new materials, such as Si,SiGe,SiC, Ge, GaAs, InGaAs, InP, GaN (N type & P type), TCO, solar cell, thin film semiconductor samples and etc.

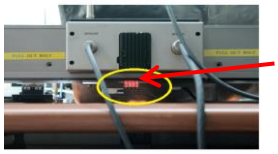
EQUIPMENT DESCRIPTION



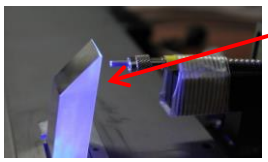
Sample mounting board

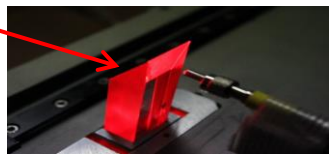
* Constant current source
- s/w pc intefaced.
- Magnet kit : 0.55Tesla (+/-0.03T) permanent magnet.
- Temperature controller: 80K~ 350K (option)
- Sample holder : gold-coated, four point probe type.

PHOTONIC MODULE


Light source


Prism

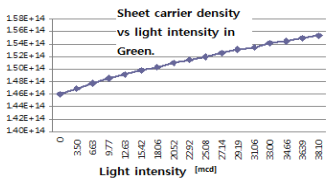




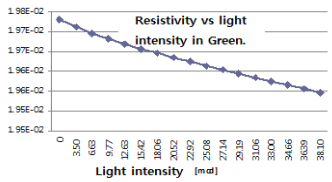
CONCLUSION - RESULTS

The graphs are showing how carrier density, mobility, resistivity and etc are changing, as per light intensity variation.

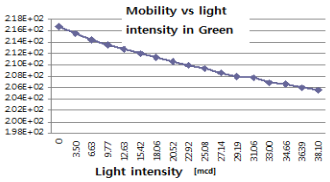
X axis is to indicates light intensity and Y axis indicates carrier density, mobility, resistivity, hall coefficient in Green light wavelength.



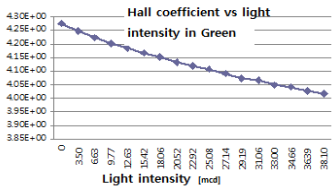
Light intensity vs carrier density



Light intensity vs resistivity



Light intensity vs mobility



Light intensity vs hall coefficient

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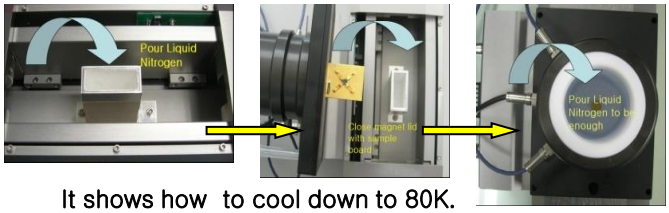
431-841. Tel) 82-31-427-8965/ e-mail: andylee@ecopia21.co.kr web: www.ecopia21.co.kr

Low Temp Hall Effect Measurement System
(HMS7000 + AMP55T) – 80K ~ 350K (Optional kits)

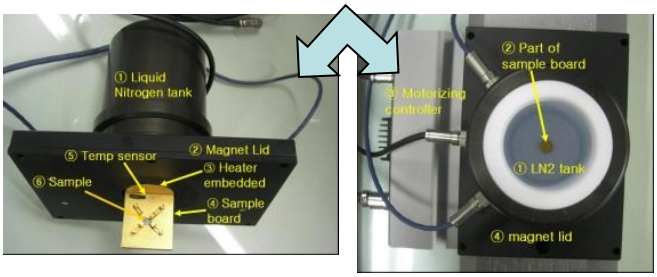
MEASUREMENT PROCESS IN LOW TEMP

< AMP55T magnet kit for measuring in low temp 80K~350K >

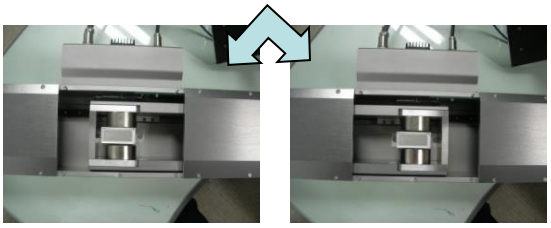


It shows how to cool down to 80K.

Model# SH80350K Sample holding kit view

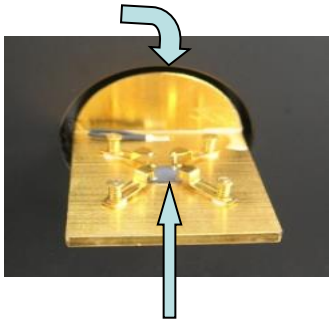


Automatic magnet movement (0.55Tesla magnet)



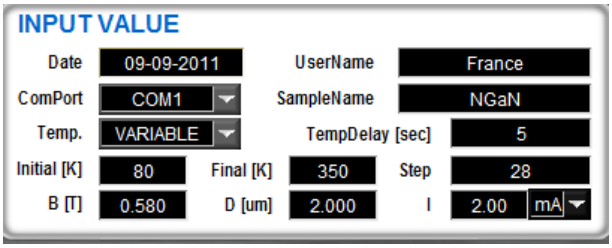
N to S polarity S to N polarity

Mounted sample on board



InSn compound must be soldered on 4point's corner as electro-conductivity materials, to improve ohmic contact.

SOFTWARE



Various buttons in s/w test page

Click "MEASURE" button.

"SAVE" button: Tested data can be saved as ".hall" and it can be converted into excel file.

"CALCUL" button: If you figured out that you made a mistake to fill incorrect D (doped thickness layer), or incorrect B (Magneto flux density), after finishing test, please click "CALCUL" button. S/S calculate data automatically.

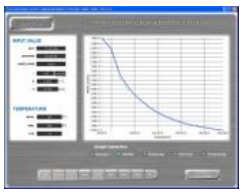
LOAD button: In s/w test page, you can recall saved data by clicking "LOAD"button.

RESULTS - TEMP vs PARAMETERS

The graphs are showing how carrier density,mobility, resistivity and etc are changing, as per temperature variation.

X axis is to indicates temperature from 80K to 350K. And Y axis indicates carrier density, mobility, resistivity.

Temp vs carrier density



Temp vs mobility

Temp vs resistivity

IV curve.

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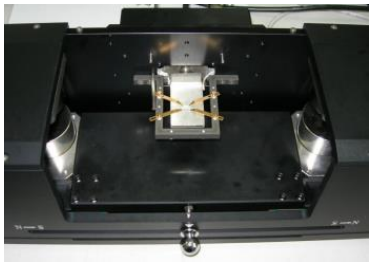
High Temp Hall Effect Measurement System

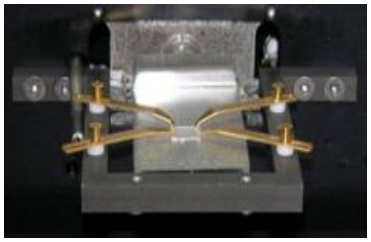
(HMS7000 + AHT55T5) – RT ~ 773K (Optional kits)

EQUIPMENT DESCRIPTION

* Constant current source
• s/w for control
• Magnet kit : 0.55Tesla(+/-0.03T) permanent magnet.
• Temperature controller: RT~ 773K(500dc)
• Sample mounting board
-Goldcoated (or Nickel coated),
- thermocouple,
- heater embedded.
- Sample must have insulating substrate ,since sample holder's surface is coated with very conductive gold(or nickel)



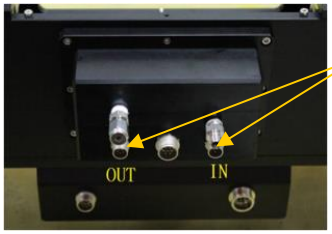
< AHT55T5 magnet kit >
measuring from RT to 773K (500dc) – Automatic movement



< Sample with heating stage >

CHAMBER AND GAS FLOW

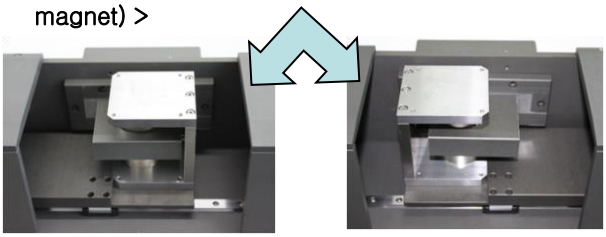
< Rear image of AHT55T5 magnet kit >



Gas Injection Input/ Ouput port for flowing purging gas

Cover the cap (chamber) to flow gas inside, and to prevent oxidization and air flow cooled on sample made by magnet movement.

< Automatic magnet movement (0.55Tesla magnet) >



N to S polarity

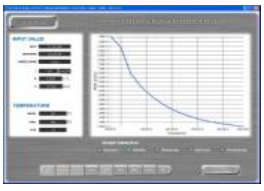
S to N polarity

RESULTS

The graphs are showing how carrier density, mobility,resistivity and etc are changing, as per temperature variation.

X axis is to indicates temperature from room temp to 773K. And Y axis indicates carrier density, mobility, resistivity and etc.

Temp vs carrier density



Temp vs mobility

Temp vs resistivity

IV curve.

* Technical Specs for HMS7000 main body
+ AMP55T + photonic module + AHT55T5

No	Parameter	HMS7000 Main body	AMP55TP Magnet kit (Compatible both low temp measurement and photonic hall module)	Photonic module	AHT55T5
1	Input current range	1nA ~ 20mA			
2	Input current Type (AC/DC)	DC only			
3	Output voltage	12V			
4	Carrier concentration (cm-3)	10exp7 ~ 10exp21			
5	Mobility (cm2/volt-sec)	1 ~ 10exp7			
6	Registivity (Ohms-cm)	10exp-4 ~ 10exp7			
7	Software	S/W can use for both low temp(AMP55T), high temp(AHT55T5), and photonic hall effect, compatibly on single software.			
8	Magnetic flux density		0.55Tesla magnet (+/- 0.03T) Automated movement		0.55Tesla magnet (+/- 0.03T) Automated movement
9	Measurable sample size		5mm x 5mm ~ 20mm x 20mm	5mm x 5mm ~ 15mm x 15mm	5mm x 5mm ~ 20mm x 20mm
10	Sample Mounting board		Model# SH80350K	Model# SPCB-00	Sample board is attached to magnet kit, not detachable
11	Temperature range		80K~ 350K Variable temp	Room Temperature	RT ~ 773K(500dC)
12	Temp resolution		±1°C		±1°C
13	Temp rising speed		80K → 350K Within 30min		RT→ 773K(500dC) Within 30min
14	Light source			White, Red, Green, Blue LED	

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