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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.

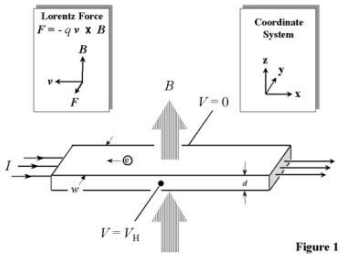


Figure 1

* Van der pauw technique

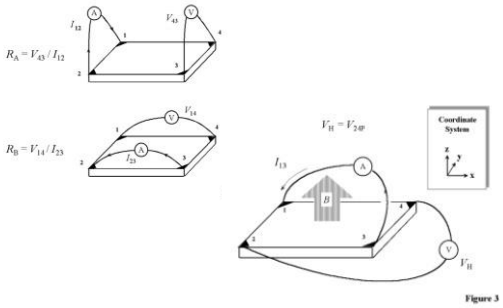
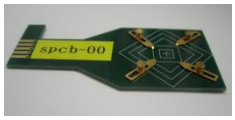


Figure 3

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.

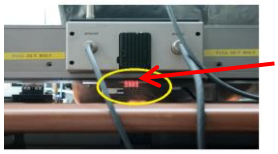
EQUIPMENT DESCRIPTION



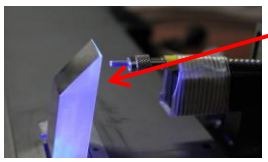
Sample mounting board

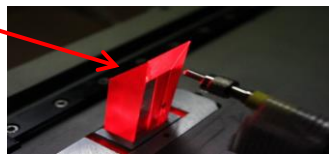
* Constant current source
- s/w pc intefaced.
- Magnet kit : 0.55Tesla (+/-0.03T) permanent magnet.
- Temperature controller: 80K~ 350K (option)
- Sample holder : gold-coated, four point probe type.

PHOTONIC MODULE


Light source


Prism

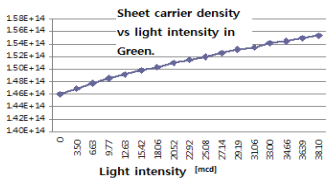




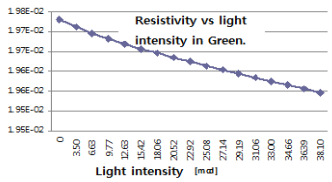
CONCLUSION - RESULTS

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

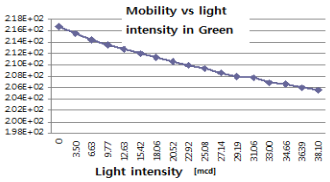
X axis is to indicates light intensity and Y axis indicates carrier density, mobility, resistivity, hall coefficient in Green light wavelength.



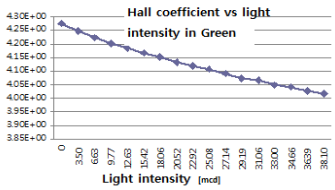
Light intensity vs carrier density



Light intensity vs resistivity



Light intensity vs mobility



Light intensity vs hall coefficient

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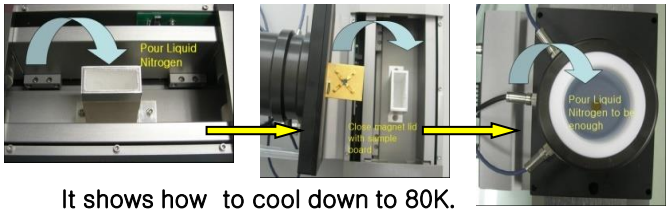
Low Temp Hall Effect Measurement System
(HMS7000 + AMP55T) – 80K ~ 350K (Optional kits)

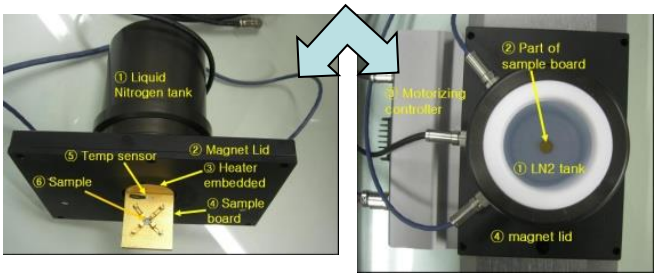
MEASUREMENT PROCESS IN LOW TEMP

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

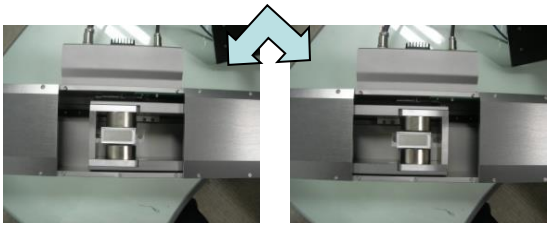


It shows how to cool down to 80K.

Model# SH80350K Sample holding kit view

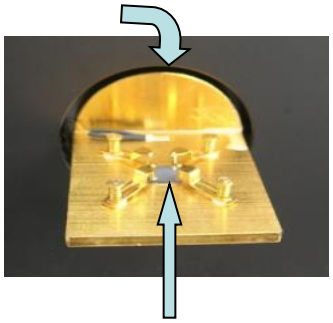


Automatic magnet movement (0.55Tesla magnet)



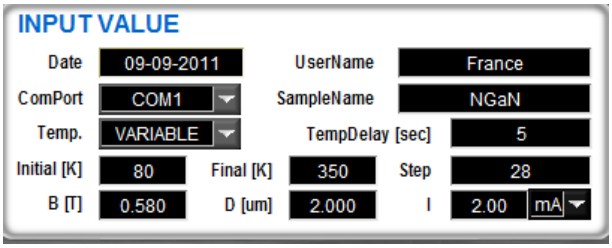
N to S polarity S to N polarity

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.

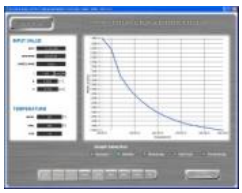
LOAD button: In s/w test page, you can recall saved data by clicking "LOAD"button.

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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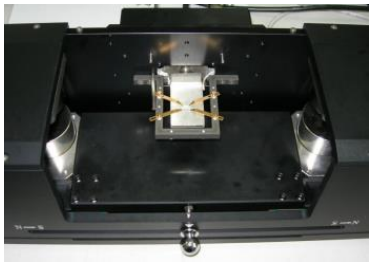
High Temp Hall Effect Measurement System

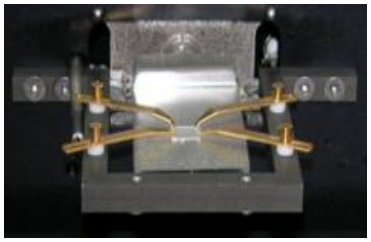
(HMS7000 + AHT55T5) – RT ~ 773K (Optional kits)

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)



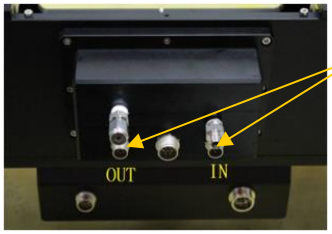
< AHT55T5 magnet kit >
measuring from RT to 773K (500dc) – Automatic movement



< Sample with heating stage >

CHAMBER AND GAS FLOW

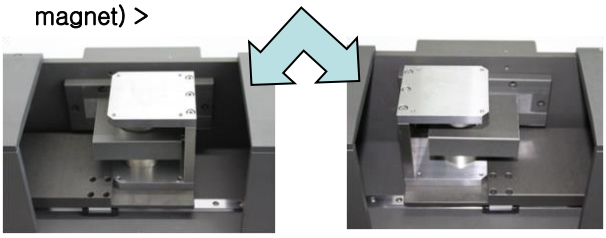
< Rear image of AHT55T5 magnet kit >



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

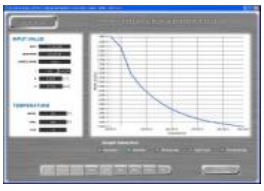
S to N polarity

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	