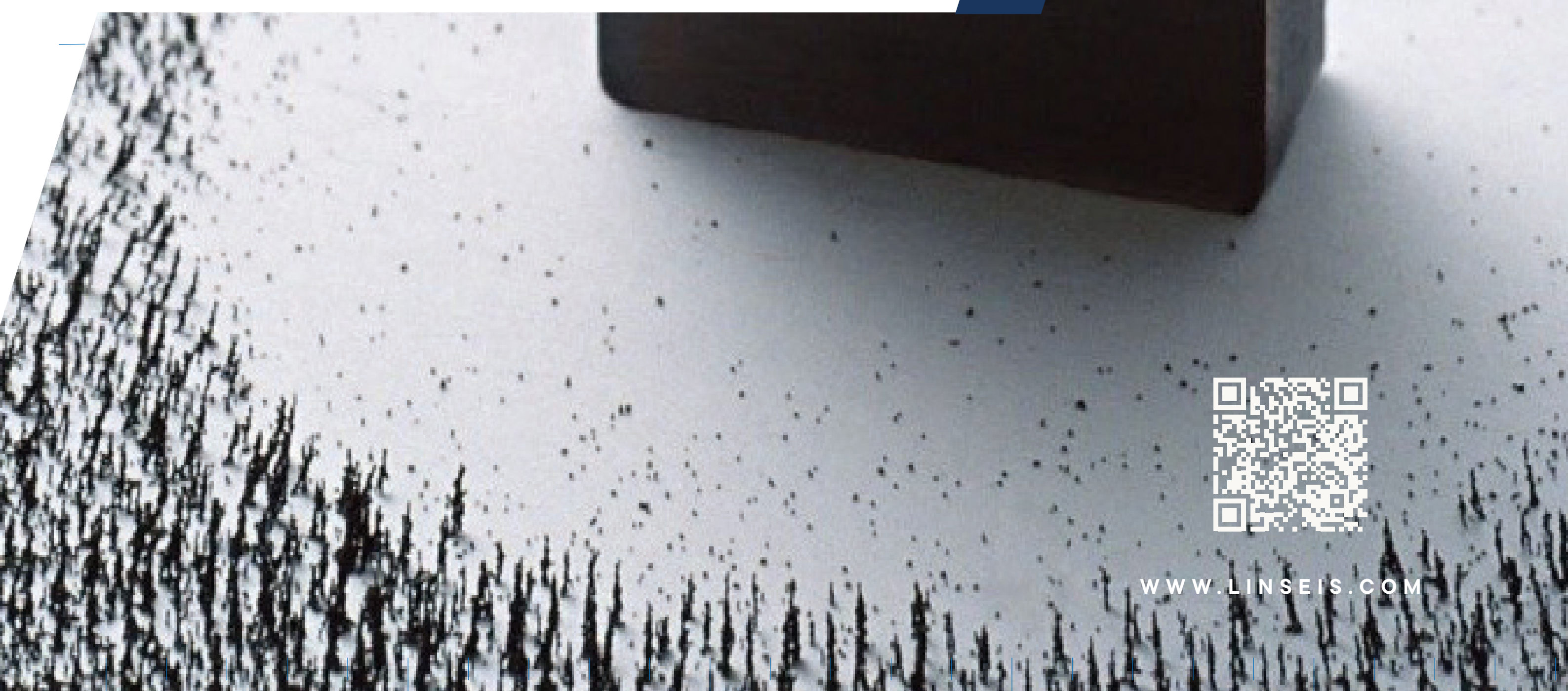
LINSEIS

pushing boundaries

HCS L36 BASIC/ ADVANCED/ULTIMATE

Hall-Effect **Characterization System**



WWW.LINSEIS.COM

Since 1957 LINSEIS Corporation has been delivering outstanding service, know-how and leading innovative products in the field of thermal analysis and thermo-physical properties.

Customer satisfaction, innovation, flexibility, and high quality are what LINSEIS represents. Thanks to these fundamentals, our company enjoys an exceptional reputation among the leading scientific and industrial organizations. LINSEIS has been offering highly innovative benchmark products for many years.

The LINSEIS business unit of thermal analysis is involved in the complete range of thermoanalytical equipment for R&D as well as quality control. We support applications in sectors such as polymers, chemical industry, inorganic building materials, and environmental analytics. In addition, thermophysical properties of solids, liquids, and melts can be analyzed.

Rooted in a strong family tradition, LINSEIS is proudly steered into its third generation, maintaining its core values and commitment to excellence, which have been passed down through the family leadership. This generational continuity strengthens our dedication to innovation and quality, embodying the essence of a true family-run business.

LINSEIS provides technological leadership. We develop and manufacture thermoanalytic and thermophysical testing equipment to the highest standards and precision. Due to our innovative drive and precision, we are a leading manufacturer of thermal analysis equipment.

The development of thermoanalytical testing machines requires significant research and a high degree of precision. LINSEIS Corp. invests in this research to the benefit of our customers.

CLAUS LINSEIS

CEO DIPL. PHYS.

To strive for the best due diligence and accountability is part of our DNA. Our history is affected by German engineering and strict quality control.

We want to deliver the latest and best technology for our customers. LINSEIS continues to innovate and enhance our existing thermal analyzers. Our goal is to constantly develop new technologies to enable continued discovery in Science.

Enginering & Innovation

Linseis **Service**

Customized Solutions - The Linseis Advantage

At Linseis, we believe that every measurement challenge is unique — and so should be your instrument.
While many suppliers rely on standardized configurations, Linseis distinguishes itself through exceptional flexibility and the capability to deliver customer-specific adaptations in record time.

Our experienced engineering teams work hand in hand with you to design and implement fully customized solutions that meet your precise application requirements — whether that means a unique sensor configuration, an extended temperature range, or a specialized software integration.

With decades of experience and a modular product architecture, we turn customization into a standard service — fast, efficient, and reliable.
Choose Linseis and experience what true flexibility in thermal analysis and material characterization means.

Contact form

Service & Support

Redefining Ownership

When investing in analytical instrumentation, long-term value matters just as much as precision. That's why Linseis systems are engineered to deliver the lowest **Total Cost of Ownership** in their class — combining reliability, efficiency, and flexibility in every detail.

Our instruments are built with robust, high-quality components designed for longevity and minimal maintenance. This means fewer service interventions, shorter downtimes, and reduced operating costs over the entire product lifetime. Intelligent software updates and remote support further ensure that your system remains state-of-the-art, even years after installation.

Hall-Effect **Characterization System**

The LINSEIS HCS (Hall-Effect Characterization System) enables the characterization of semiconductor devices in terms of their electrical transport properties, particularly Hall mobility, charge carrier concentration, resistivity and Seebeck coefficient.

The integrated desktop setups offer a complementary range of products, from a basic manually operated Hall characterization stage to an automated high-temperature stage (HCS L36 Ultimate) and an innovative Halbach configuration (HCS L36 Advanced) for characterising the most challenging samples.

HCS L36 *Ultimate*

HCS L36 *Basic*

HCS L36 *Advanced*

Measurement features

- Charge Carrier Concentration (Sheet [1/cm^2]/ Bulk [1/cm^3])
- Hall-Constant [cm^3/C]
- Hall-Mobility [cm^2/Vs]
- Sheet resistance [Ω]
- Resistivity [Ωcm]
- Conductivity [S/cm]
- Alpha (horizontal/vertical ratio of resistance)
- MAGNETO resistance
- Seebeck Coefficient [µV/K]

DC or AC Hall Effect Measurements

Product Line

HCS L36 *Basic* -
For Routine Measurements

Only DC measurement
Resistivity: 10^{-4} up to 10^{7} Ω·cm
Charge carrier concentration:
10^{7} up to 10^{21} cm^{-3}
Mobility: 0.1 up to 10^{7} $cm^{2}/V\cdot s$

HCS L36 *Advanced* -
For high-precision Thin Film Research

DC and AC measurement
Resistivity: 10^{-4} up to 10^{7} Ω·cm
Charge carrier concentration:
10^{7} up to 10^{23} cm^{-3}
Mobility: 10^{-2} up to 10^{7} $cm^{2}/V\cdot s$

HCS L36 *Ultimate* -
Complete Research Platform

DC and AC measurement
Resistivity: 10^{-4} up to 10^{7} Ω·cm
Charge carrier concentration:
10^{7} up to 10^{21} cm^{-3}
Mobility: 0.01 up to 10^{7} $cm^{2}/V\cdot s$

Unique features

Halbach Magnet for exceptional field homogeneity

The optimised Halbach magnet array produces an exceptionally homogeneous magnetic field across the entire measurement area. This results in stable field conditions that minimise systematic measurement errors and enable highly accurate and reproducible determination of the Hall coefficient, carrier concentration and mobility.

Intelligent Sample Holder Recognition

Standard sample holders equipped with an integrated EPROM are automatically recognized by the software. Measurement parameters are loaded instantly, enabling fast setup, minimizing user interaction and reducing the risk of configuration errors.

One Measurement - Four Parameters

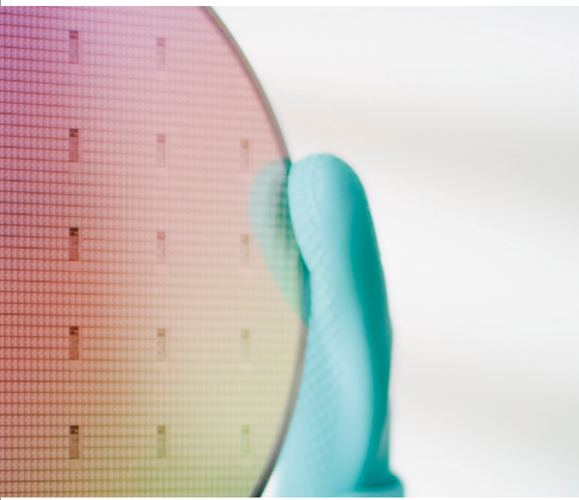
Simultaneous determination of the Hall coefficient, electrical resistivity, carrier concentration and Hall mobility within a single measurement for complete electrical material characterization.

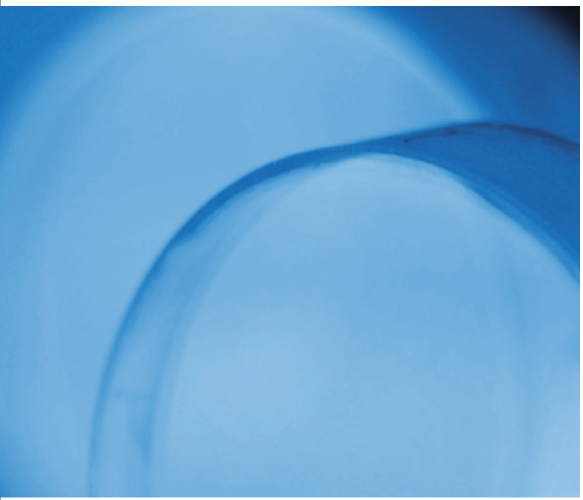
Large sample compatibility

Compatible with standard sample holders for samples up to 12.5 × 12.5 mm², eliminating the need for dedicated sample carriers and simplifying sample preparation for a wide range of materials.

Modern Modular Instrument Design

The instrument architecture has been completely redesigned to combine an optimised mechanical layout with improved accessibility and streamlined operation for everyday laboratory use.





Temperature range -160 °C up to 600 °C

The **LINSEIS HCS L36** system is capable of performing applications at temperatures of up to 600 °C in a single run.

Automatic calibration

The integrated automatic calibration function in both software and hardware significantly simplifies operation. The HCS L36 automatically determines and applies the required calibration factor, which is displayed transparently to the user. This minimizes user intervention and reduces the risk of calibration errors.

Customization

Close collaboration with customers to develop customized solutions, leveraging LINSEIS's expertise to meet their specific requirements.

Service

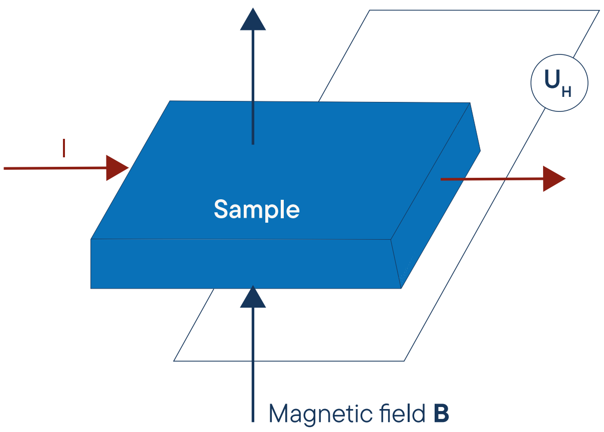
Our international presence across every continent enables us to deliver the best and fastest service possible.

Hall Effect

The **Hall effect** provides the physical basis for determining key transport parameters in solids. The Hall voltage, which is induced by a perpendicular magnetic field, is directly related to the type, density, and mobility of the charge carriers, thereby enabling the comprehensive characterization of materials.

The voltage is called **Hall voltage U_H**

Measuring Principle



The Hall voltage U_H is measured perpendicular to the direction of current flow. The sign of U_H allows the dominant charge carrier type (*n-type* or *p-type*) to be determined.

$$\boxed{U_H = A_H \cdot \frac{I \cdot B}{d}}$$

A_H:	Material dependent Hall constant
I:	Current through the conductor
B:	Magnetic flux density
d:	Thickness of the conductor parallel to the magnetic field direction

Derived parameters

Charge Carrier Concentration *(n or CCC)*

$$\boxed{n = \frac{1}{A_H \cdot e}}$$

e: elementary charge

Hall mobility (μ)

$$\boxed{\mu = \frac{A_H}{\rho}}$$

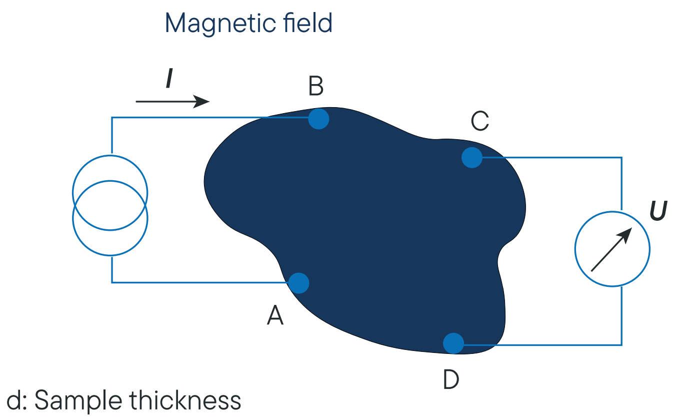
ρ: electrical resistivity

Van-der-Pauw method

The **Van-der-Pauw method** is used to determine the **electrical conductivity (σ)** and **Hall constant (A_H)** of the sample. After the sample has been deposited on the chip, it is connected to four electrodes (A, B, C and D) at its edge.

During the measurement process, a current is applied between two contacts, and the corresponding voltage between the remaining two contacts is measured. By changing the contacts clockwise and repeating the procedure, the resistivity of the sample can be calculated using the van der Pauw equation.

Measuring Principle



The Hall constant of the sample can be calculated by applying a magnetic field and measuring the corresponding change in the diagonal Van-der-Pauw resistance.

For resistivity:

$$\exp\left(\frac{\pi d}{\rho} \cdot R_{AB,CD}\right) + \exp\left(\frac{\pi d}{\rho} \cdot R_{AB,CD}\right) = 1$$

For Hall constant:

$$A_H = \frac{d}{\Delta B} \cdot \Delta R_{BD,CA}$$

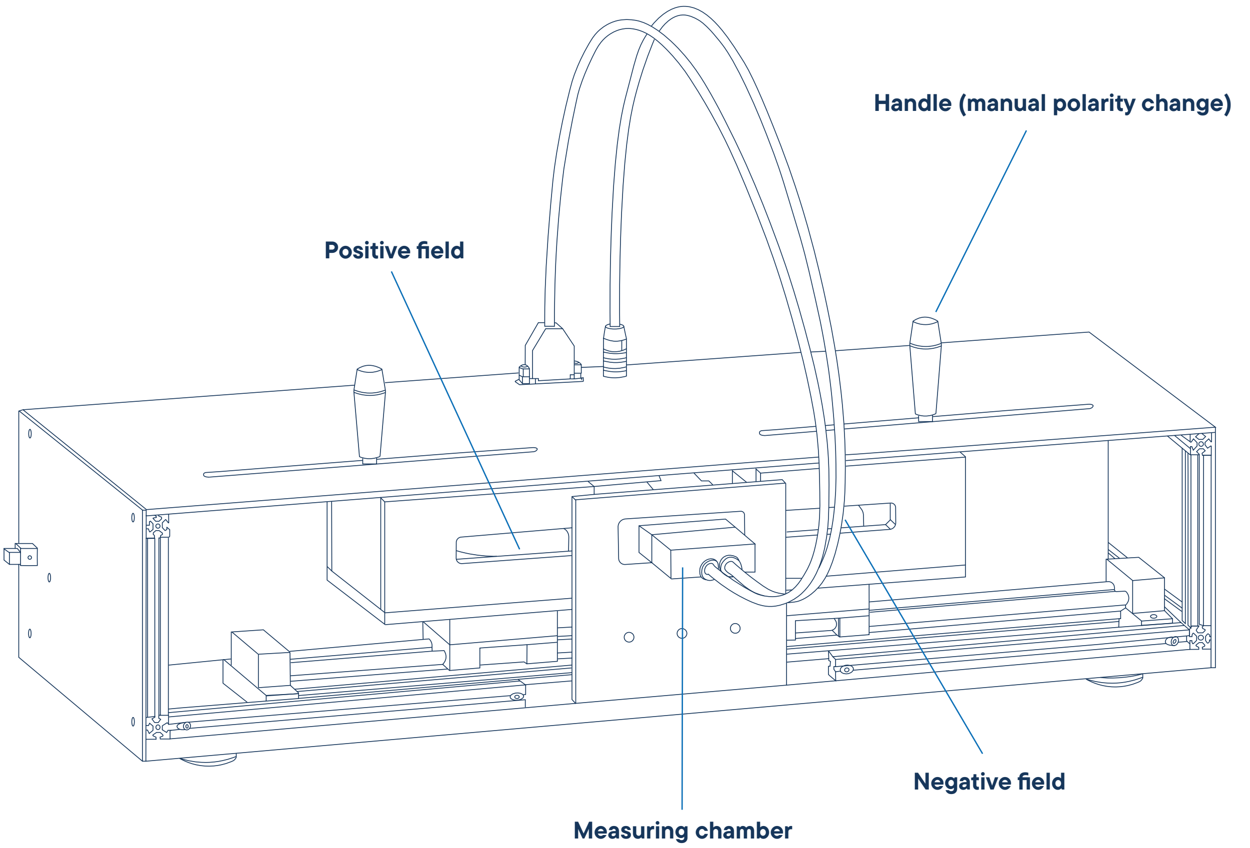
where

$$\Delta R_{BD,CA} = R_{BD,CA\,(B_1)} - R_{BD,CA\,(B_0)}$$

with $R_{BD,CA} = U_{BD} / I_{CA}$

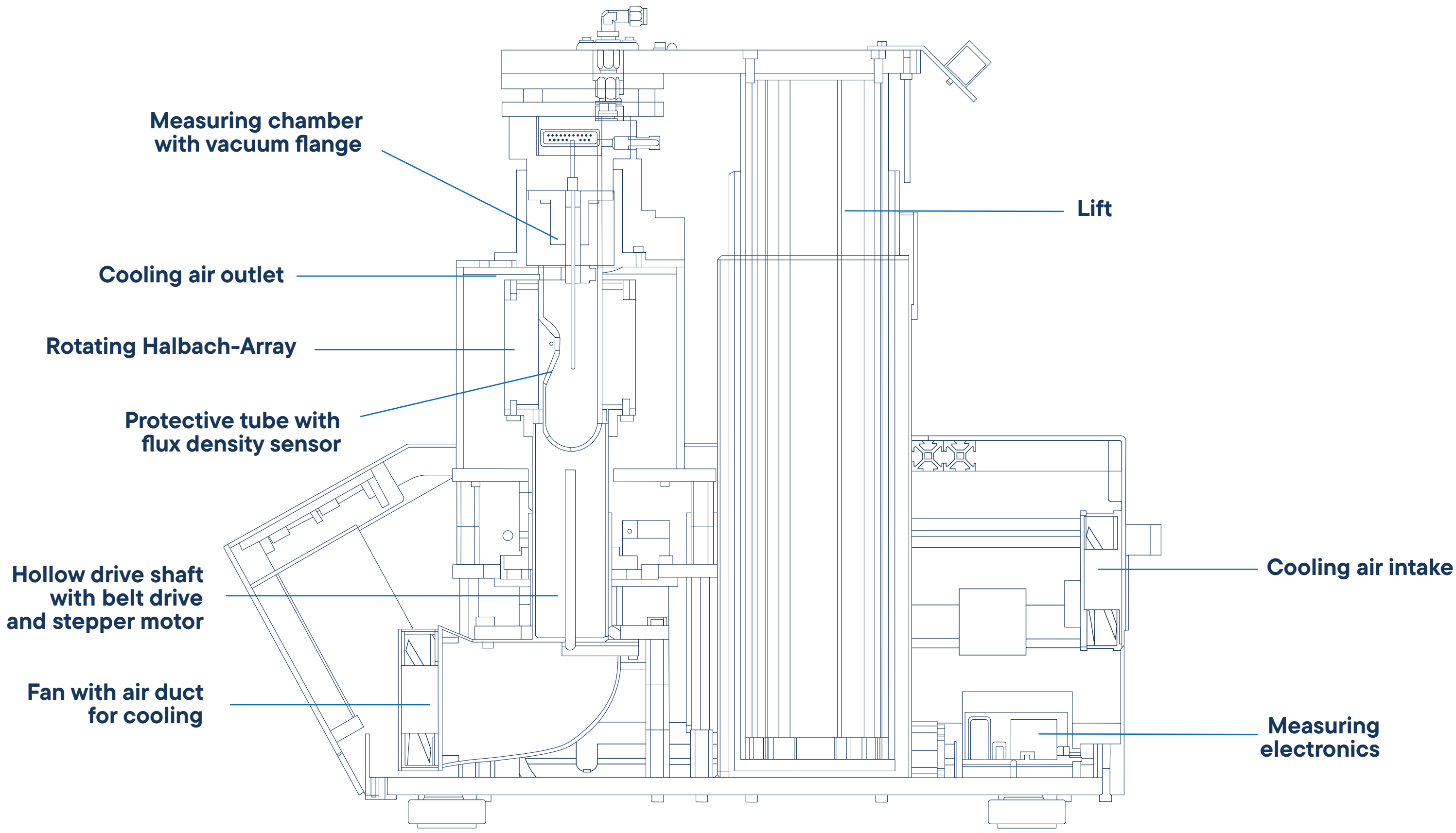
Linseis WIKI
Hall Effect

The **HCS L36 *Basic*** features two pairs of 120 mm diameter neodymium permanent magnets. These allow for a highly homogeneous magnetic field with a flux density of at least ± 0.6 T. The Hall coefficient sample is measured using a direct current (DC) excitation. The bipolar current source enables the Hall voltage to be separated from DC offsets, such as thermo-voltages.



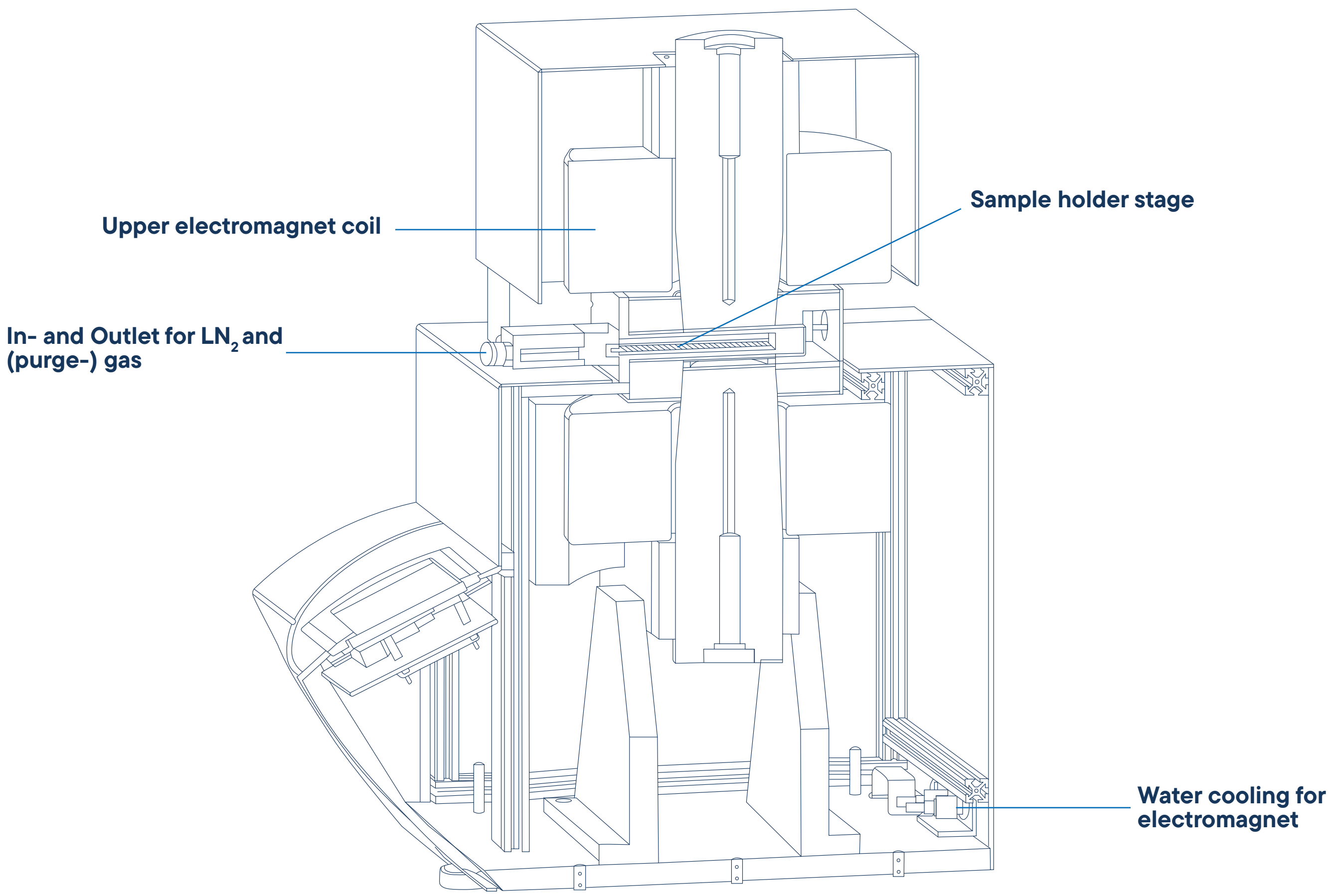
Schematic illustration of the HCS L36 *Basic*

The **HCS L36 *Advanced*** system uses a Halbach magnet with ±0.5 T and offers both DC and AC modes. The Halbach-Magnet is a magnet array consisting of multiple permanent magnet segments.
Due to the specific two-pole layout of the magnets, a magnetic field with very homogenous flux density is formed in the center.
By spinning the entire array around its own axis, the flow of flux density is sin(B) in the center, so it is alternating in a sinusodial course.
In addition, the flux density in the center is amplified, whereas the flux density on the outside is relatively weak.



Schematic illustration of the HCS L36 *Advanced*

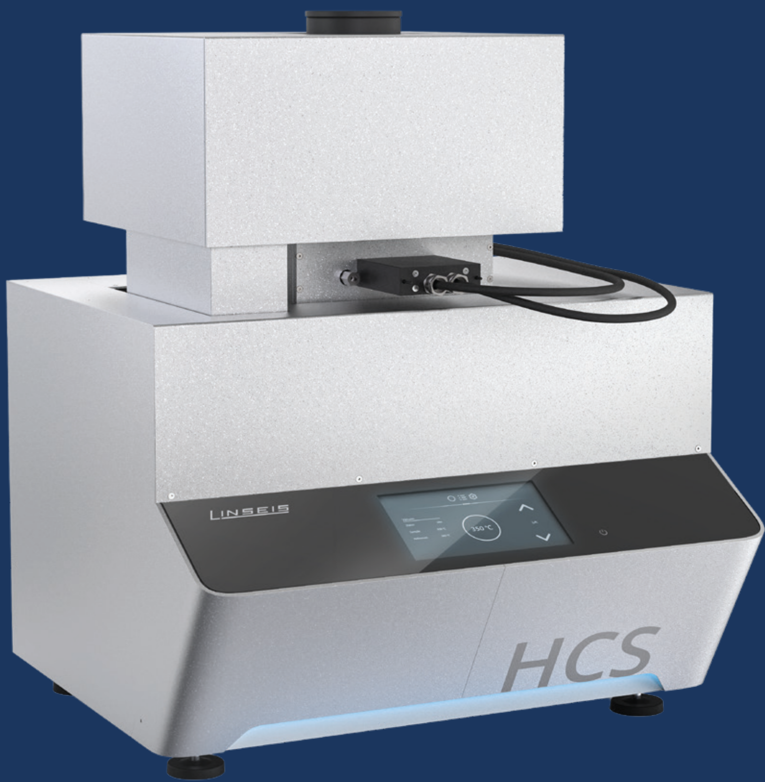
The **HCS L36 *Ultimate*** is equipped with a water-cooled electromagnet. That allows for measurements under a user-adjustable DC magnetic flux density range. The device is also available with an AC power supply for the electromagnet. The alternating magnetic field generates an alternating hall voltage when a DC excitation current is used. The misalignment voltage caused by sample asymmetry and thermovoltages is meaningless for the AC Amplitude measured.
The AC-share of the measured voltage consists only of the hall voltage and a voltage induced into the conductor loops. The AC signal is processed by a lock-in Amplifier with the flux density measured by a sensor to eliminate the 90° out-of-phase induced voltage.



Schematic illustration of the HCS L36 *Ultimate*

The systems can be equipped with different sample holders to accommodate various geometries and temperature requirements. An optional low-temperature version using liquid nitrogen (LN_2) is available, as well as a high-temperature version of up to 600 °C, to ensure that all fields of application can be covered. Depending on the system configuration, a permanent magnet, a water-cooled electromagnet or a Halbach magnet can provide a magnetic field strength of up to 0.5 Tesla.

This comprehensive, Windows-based software offers a user-friendly graphical interface for controlling system parameters and defining measurement procedures and temperature profiles.
It also allows for easy data evaluation and presentation.



HCS L36 *Ultimate*

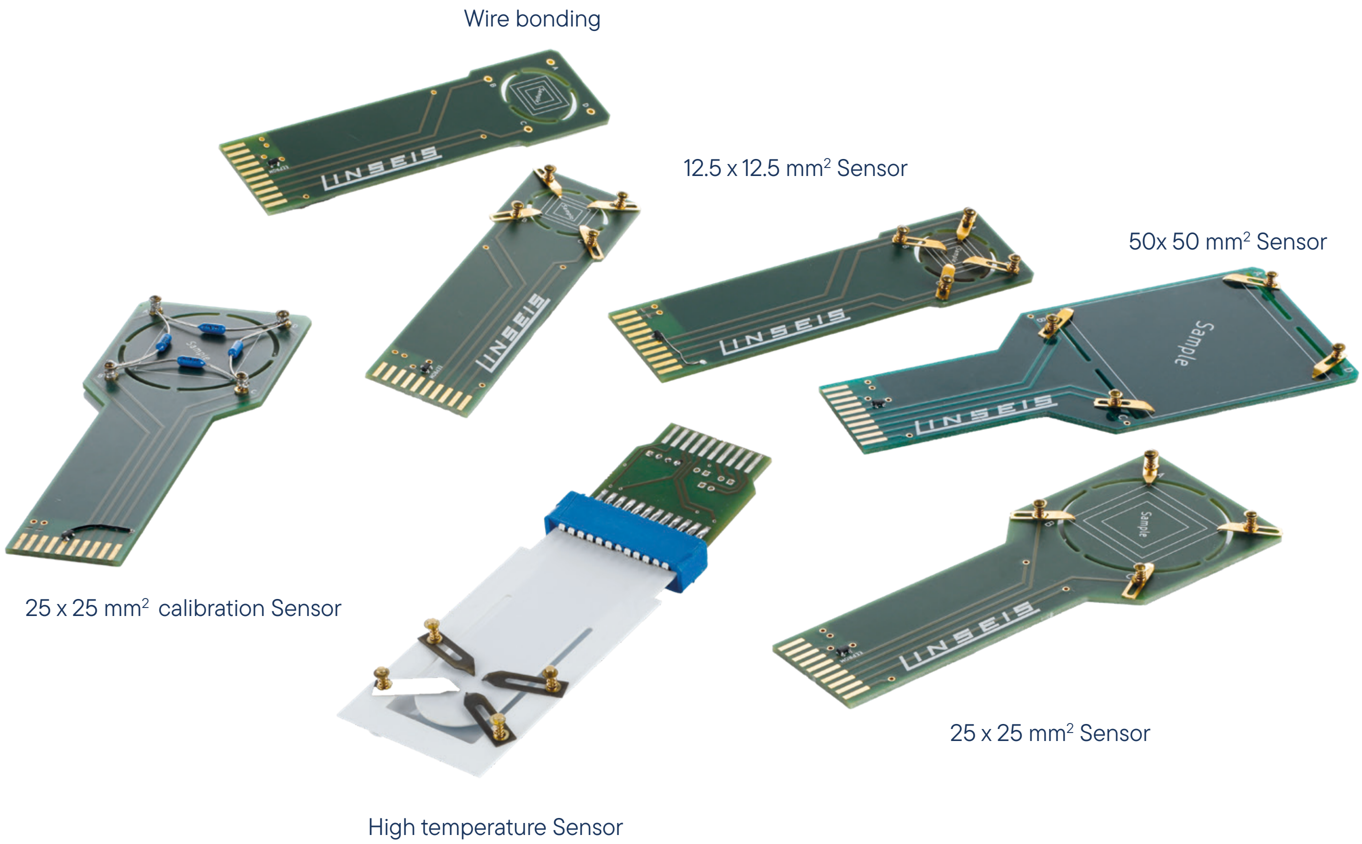
System features

- Gas tight measurement chamber which allows measurements under defined atmospheres or vacuum conditions
- 120 mm diameter magnets for highest field homogenity and maximum accuracy as well as biggest measureable sample sizes
- Modular and upgradeable system design
- High temperature version up to 600 °C
- Lock-in amplifier upgrade for lowest noise measurements
- Connector for use of external electronics
- Integrated software package for easy handling
- Seebeck Coefficient opition: typically up to 10 K

Sensors

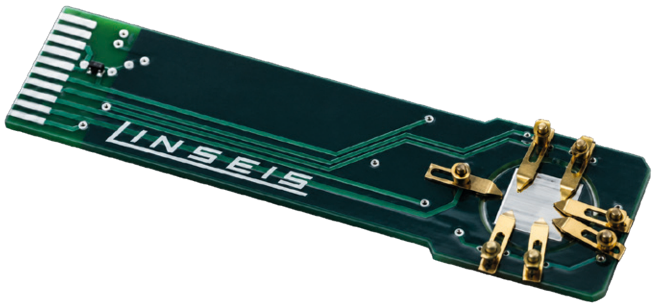
Thanks to their modular design, the **Linseis HCS systems** can be easily expanded to cover a wide range of applications. These include the Seebeck option, the gated Hall bar setup and the illumination option. The plug-and-play system of the sample boards allows the measurement mode to be changed quickly and easily.

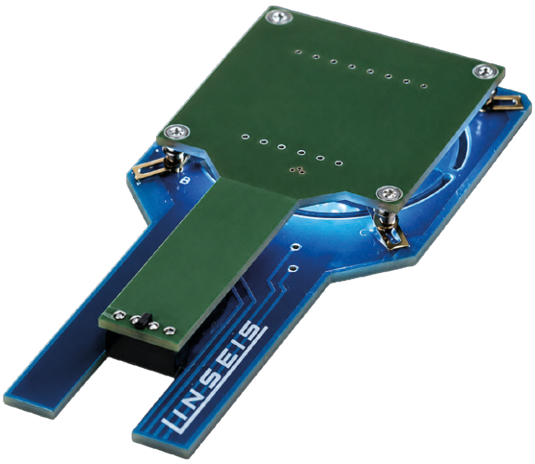
Exchangeable sensor with intelligent recognition for plug-and-play-usage.



(Gated) Hall bar

The sample holder can be used to characterise nanowires and transistors for Hall bar or gated Hall bar measurements, for example. It can be used to determine electrical conductivity and Hall mobility, as well as all quantities derived from these properties. Furthermore, it enables properties to be investigated in relation to an additional applied electric field, i.e. the gate. Please note that the sample structure (i.e. the contact scheme) differs between the gated Hall bar and Van der Pauw setups, so the sample must be prepared accordingly.





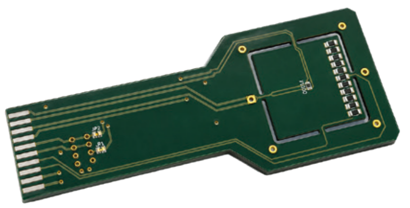
Illumination Option

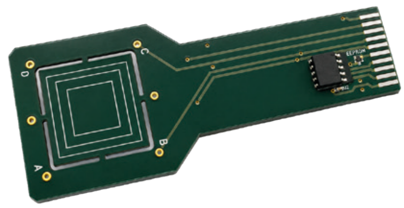
The illumination option allows Hall effect investigations to be conducted on illuminated samples. This allows the effects to be analysed by irradiating the sample with different wavelengths of light from the blue, green and red spectrum and varying the illuminance. It also means that additional sample holders can be used to study the photoelectric effect. Consequently, this option is particularly interesting for materials used in photovoltaic systems.

A wide variety of sample holders for different sample sizes and measurement types can be plugged into the sample holder socket. The vacuum-tight chamber allows samples to be measured under defined atmospheres.

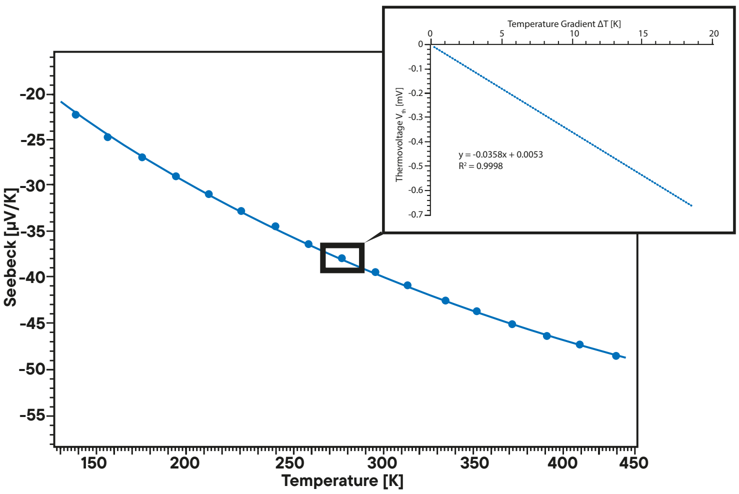
Seebeck Option

	HCS L36 *Basic, Advanced, Ultimate*
Sample Geometry	length: 6 to 20 mm width: 1 to 20 mm heigth: thin film up to 2 mm
Seebeck Coefficient	-2500 µV/K to 2500 µV/K
Measurement	Slope technique: eliminates errors caused by temperature gradient offset or Seebeck voltage offset
Gradient heater	Seebeck-Gradient typically 10 K
Thermocouples	Type K





Measurement of an Constantan reference sample

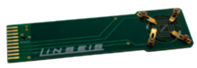
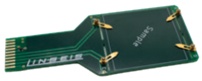
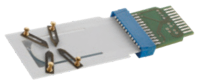
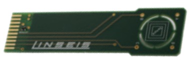
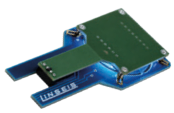


Measurement of the Seebeck coefficient on a Constantan reference sample from -140 °C to +180 °C. The Seebeck coefficient was measured using the slope technique (see inset) at each temperature. The results can be plotted as either the relative Seebeck coefficient against Pt or the absolute Seebeck coefficient.

Technical **Specifications**

	HCS L36 *Basic*	HCS L36 *Advanced*	HCS L36 *Ultimate*
Temperature range	LN_2 up to 600 °C in different versions (continuously from LT to HT) -160 °C (controlled co-oling) -196 °C (quench cooling)	RT up to 600 °C LN2 up to 600 °C in different versions	LN2 up to 600 °C in different versions (continuously from LT to HT) -160 °C (controlled co-oling) -196 °C (quench cooling)
Magnet	Permanent magnets up to 0.70 T DC field Pole diameter 120 mm Two magnet setup for bi-polar measurement.	Magnet up to 0.5 T (AC or DC field) Multisegment Halbach confi-guration Frequency: 0.01 up to 1 Hz	Electromagnet with 76 mm of pole diameter. AC power supply for measu-rements up to 0.1 Hz at up to +-40 A
Current source	**DC** 1 nA up to 125 mA (8 decades / Compliance +/- 12 V)		
Voltage measurement	**DC** low noise / low drift 1 µV up to 2500 mV 4 decades amplification Digital resolution: 300 pV	**DC** low noise / low drift 1µV up to 2500mV 4 decades amplification Digital resolution: 300pV **AC** 20 nV up to 1V Features: GΩ range input impedance, variable integration times and amplfication	
Sensors / Sample geometry	Seebeck Sensor, Illumination Sensor, Gated hall bar from 5 x 5 mm^2 to 12.5 x 12.5 mm^2 Maximum sample height 3 mm from 17.5 x 17.5 mm^2 up to 25 x 25 mm^2 Maximum sample height 5 mm from 42.5 x 42.5 mm^2 up to 50 x 50 mm^2 Maximum sample height 5 mm High Temperature board from 10 x 10 mm^2, max. sample height 3 mm	Seebeck Sensor, Illumination Sensor, Gated hall bar from 5 x 5 mm^2 to 12.5 x 12.5 mm^2 Maximum sample height 3 mm High Temperature board from 10 x 10 mm^2, max. sample height 3 mm From 17.5 x 17.5 mm^2 up to 25 x 25 mm^2, max. sample height 3 mm	Seebeck Sensor, Illumination Sensor, Gated hall bar from 5 x 5 mm^2 to 12.5 x 12.5 mm^2 Maximum sample height 3 mm from 17.5 x 17.5 mm^2 up to 25 x25 mm^2 Maximum sample height 5 mm from 42.5 x 42.5 mm^2 up to 50 x 50 mm^2 Maximum sample height 5 mm High Temperature board from 10 x 10 mm^2, max. sample height 3 mm
Resistivity Range	10^{-4} up to 10^7 (Ωcm)	10^{-4} up to 10^7 (Ωcm)	10^{-4} up to 10^7 (Ωcm)
Carrier concentration	10^7 up to $5x10^{22}$ cm^{-3}	10^3 up to 10^{23} cm^{-3}	10^7 up to 10^{23} cm^{-3}
Mobility range	0.1 ~ 10^7 cm^2/Vs	10^{-3} up to $10^7 cm^2/Vs$	10^{-3} ~ 10^7 $cm^{2/}$ Vs
Atmospheres	Vacuum, inert, oxidizing, reducing	Vaccum, inert, oxidizing, reducing	Vaccum, inert, oxidizing, reducing
Temperature resolution	0.001 °C	0.001 °C	0.001 °C
Option: Gate-bias	Voltage range 10 mV -100 V Current range 1 µA -100 mA	Voltage range 10 mV -100 V Current range 1 µA -100 mA	Voltage range 10 mV -100 V Current range 1 µA -100 mA

*The actual measurement range depends on the properties of the sample and the geometry

Type	Sample size	Visualisation	HCS L36 *Basic*	HCS L36 *Advanced*	HCS L36 *Ultimate*
12.5 x 12.5 mm	from 5 x 5 mm^2 to 12.5 x 12.5 mm^2 Maximum sample height 3 mm		☺	☺	☺
25 x 25 mm	from 17.5 x 17.5 mm^2 to 25 x 25 mm^2 Maximum sample height 5 mm		☺	☺	☺
50 x 50 mm	from 42.5 x 42.5 mm^2 to 50 x 50 mm^2 Maximum sample height 5 mm		☺	☹	☺
10 x 10 mm *High Tempera-ture*	10 x 10 mm² Maximum sample height 3mm		☺	☺	☺
12.5 x 12.5 mm *Wire bonding*	from 5 x 5 mm^2 to 12.5 x 12.5 mm^2 Maximum sample height 3 mm		☺	☺	☺
25 x 25 mm *Seebeck*	from 17.5 x 17.5 mm^2 to 25 x 25 mm^2 Maximum sample height 5 mm		☺	☺	☺
25 x 25 mm *Illumination*	from 17.5 x 17.5 mm^2 to 25 x 25 mm^2 Maximum sample height 3 mm		☺	☺	☺
12.5 x 12.5 mm *(Gated) Hall bar*	from 5 x 5 mm^2 to 12.5 x 12.5 mm^2 Maximum sample height 3 mm		☺	☺	☺

☺ available   😐 on request   ☹ not available

Contact Form

Software

All LINSEIS devices are PC controlled, where the individual software modules exclusively run under Microsoft® Windows® operating systems. The integrated software enables straightforward operation, temperature control, data acquisition and data evaluation.

General Features

- NIST routine to find the optimum measurement settings and achieve the most accurate results
- Extended connection test
- Possible integration of external electronics
- Optional database storage
- Optional lock-in amplifier integration
- Automatic sensor recognition (EPROM)
- Automatic evaluation
- Fully automatic cooling regulation

LINSEIS

Hall effect measurement report

Parameters

Date:	Fri Nov 8 13:58:25 2019
Sample name:	ITO 200
Temperature:	80.02 °C
Res. current:	10 mA
Hall current:	10 mA
Thickness:	0.185 µm

Measurement data

AB [mV]	BC [mV]	AC [mV]	+MAC [mV]	-MAC [mV]
13.83	12.72	-1.109	-1.274	-0.9542

CD [mV]	DA [mV]	BD [mV]	+MBD [mV]	-MBD [mV]
13.82	12.71	1.111	0.9547	1.275

Results

Sheet resistance:	6.011 Ω	Mobility:	-38.5362 cm^2/(V s)
Resistivity:	0.0001112 Ω cm	Conductivity:	8.99e+3 /(Ω cm)
CCC (Sheet):	-2.694e+16 /cm^2	CCC (bulk):	-1.456e+21 /cm^3
AC cross Hall coefficient:	-0.004281 cm^3/C	BD cross Hall coefficient:	-0.00429 cm^3/C
Ratio of Vertical/Horizontal:	0.919626	Average hall coefficient:	-0.004285 cm^3/C
Magneto-Resistance:	0 Ω		

Fig 1: Linseis Report

LINSEIS

Hall effect measurement report

Parameters

Date:	Fri Nov 8 13:06:40 2019
Sample name:	ITO 200
Temperature:	20.09 °C
Res. current:	10 mA
Hall current:	10 mA
Thickness:	0.185 µm

Measurement data

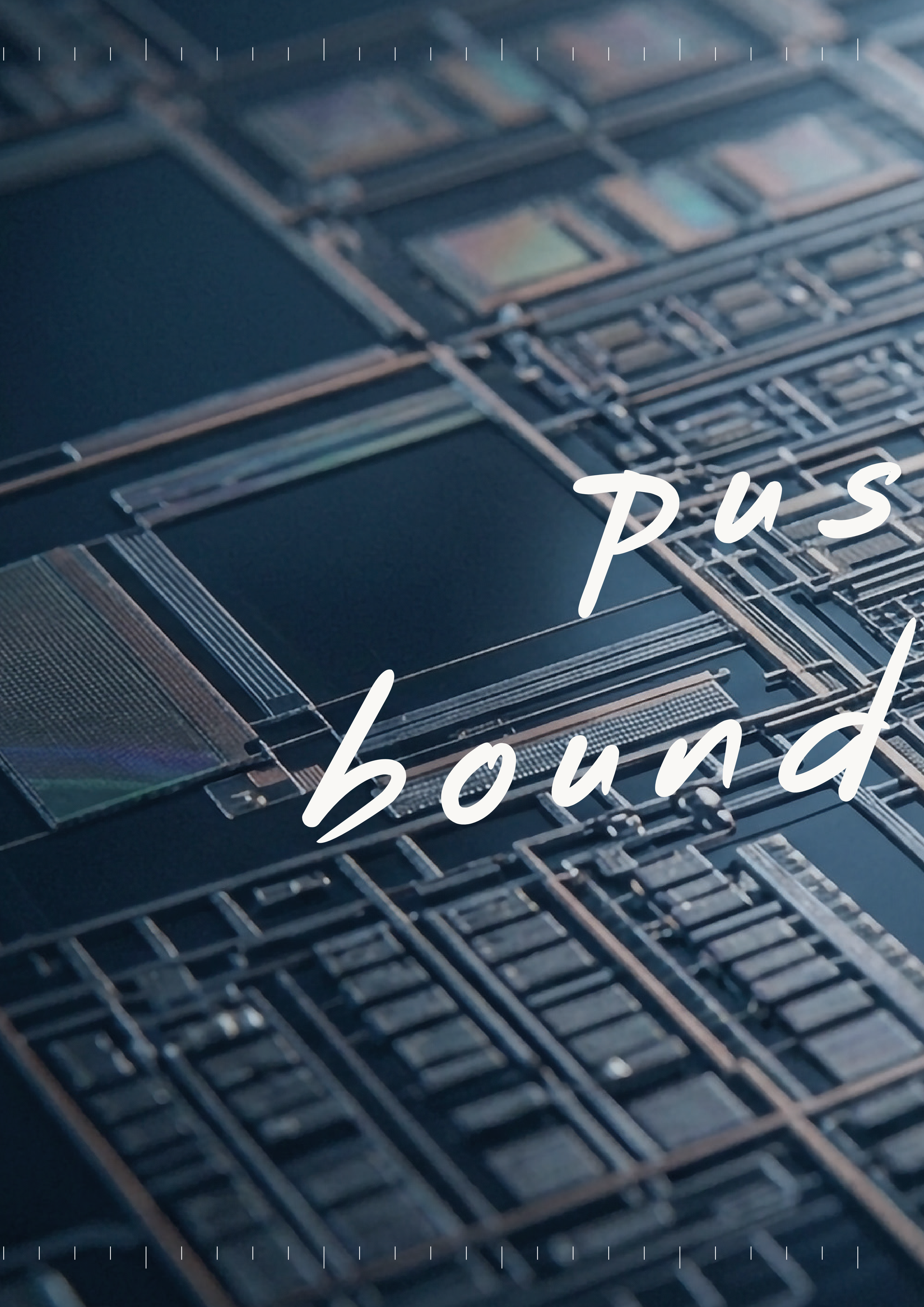
AB [mV]	BC [mV]	AC [mV]	+MAC [mV]	-MAC [mV]
13.16	12.1	-1.061	-1.226	-0.9049

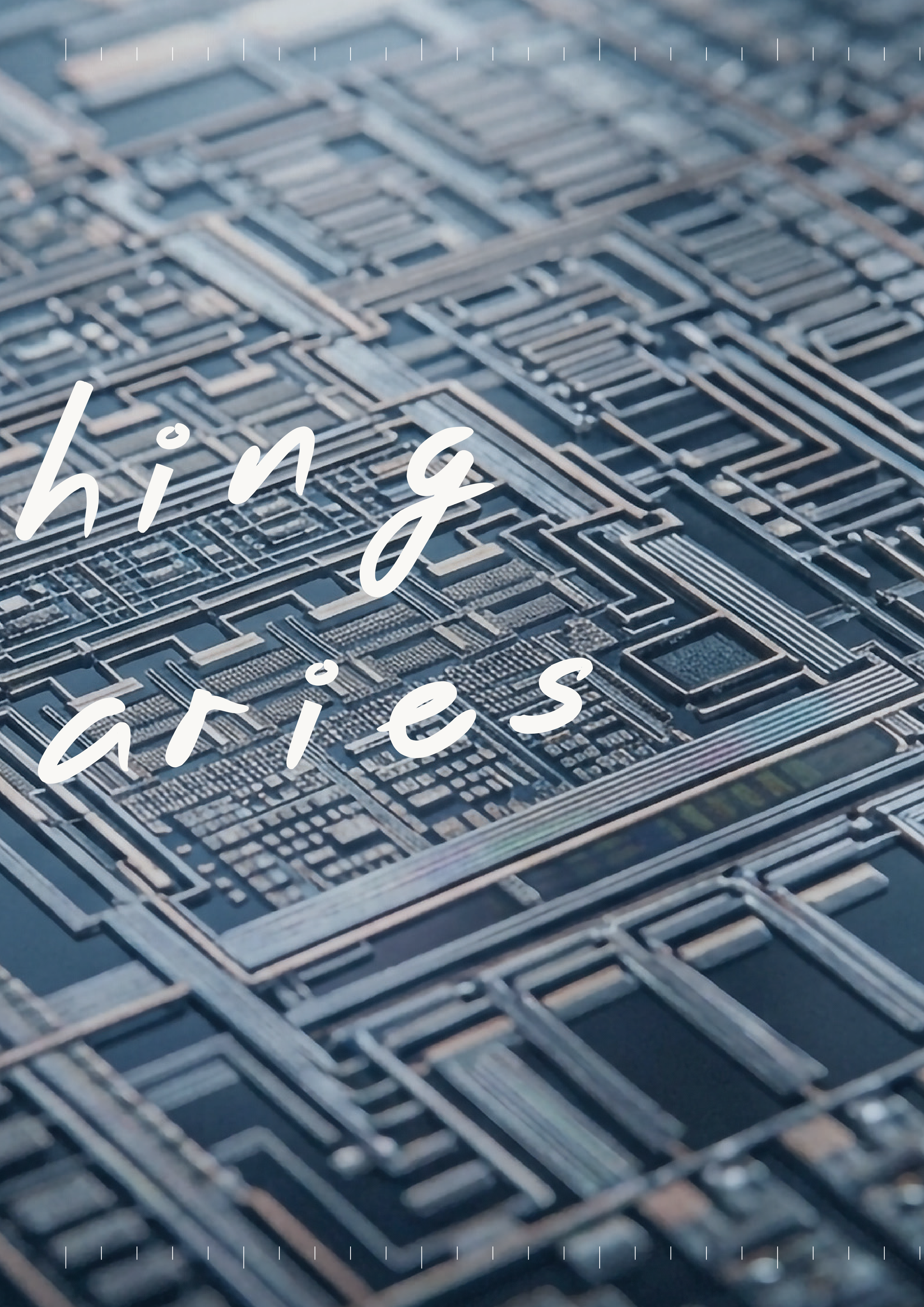
CD [mV]	DA [mV]	BD [mV]	+MBD [mV]	-MBD [mV]
13.16	12.1	1.061	0.9056	1.227

Results

Sheet resistance:	5.721 Ω	Mobility:	-40.6961 cm^2/(V s)
Resistivity:	0.0001058 Ω cm	Conductivity:	9.45e+3 /(Ω cm)
CCC (Sheet):	-2.681e+16 /cm^2	CCC (bulk):	-1.449e+21 /cm^3
AC cross Hall coefficient:	-0.004304 cm^3/C	BD cross Hall coefficient:	-0.00431 cm^3/C
Ratio of Vertical/Horizontal:	0.919333	Average hall coefficient:	-0.004307 cm^3/C
Magneto-Resistance:	0 Ω		

Fig 2: Linseis Report

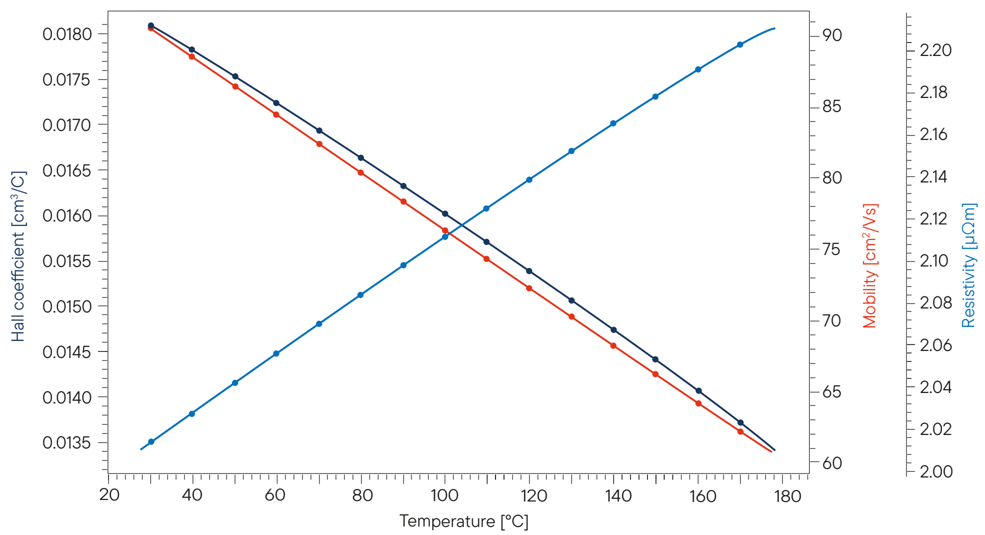

pus
bound


hing
aries

HCS Overview

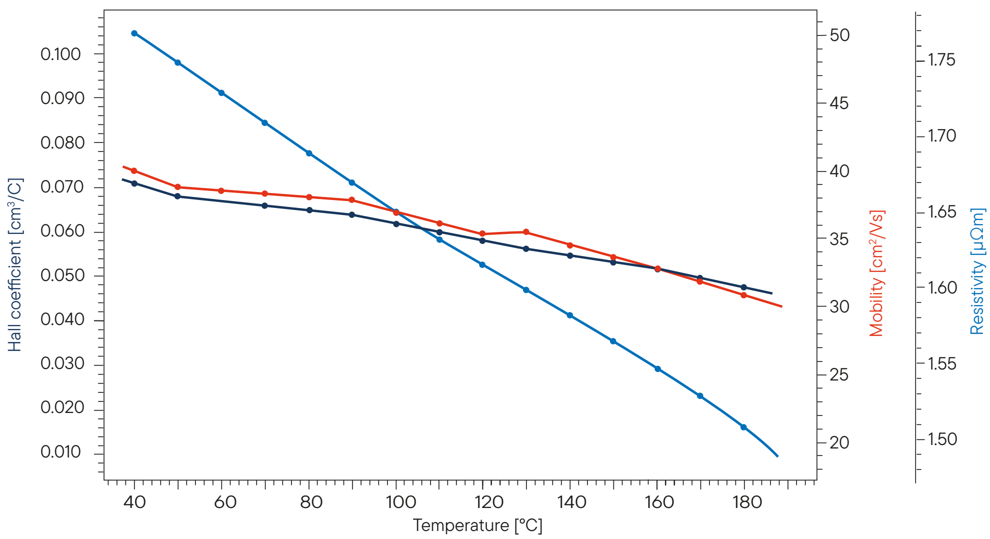
Applications

Antimony Thin Film (150 nm Sb)



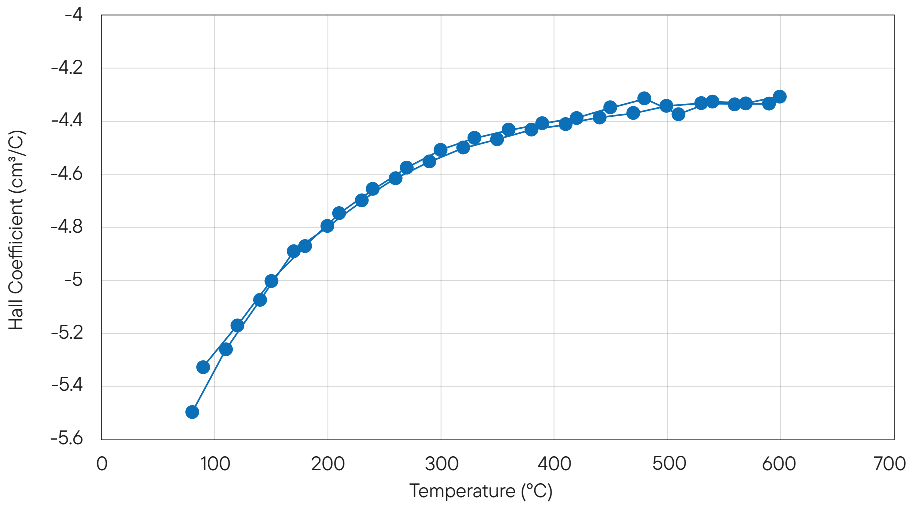
Antimony (Sb) is a semimetal, which is widely used in the field of thermoelectrics (in form of alloys, e.g. Bi1−xSbx) and as an emerging application is the field of microelectronics. Nevertheless, the largest applications for metallic antimony are lead antimony plates in leadacid batteries. The figure shows a full characterization of a thin film on SiO2/Si substrate, prepared by sputter deposition, with the Linseis HCS L36 Basic (RT to 200 °C option).

Bismuth-antimony Thin Film (150 nm Bi87Sb13)



Bismuth-antimony alloys, (Bi1−xSbx) are binary alloys of bismuth and antimony in various ratios. In particular, the alloy $Bi_{0.9}Sb_{0.1}$ was the first three-dimensional topological insulator to be observed experimentally. These materials have conducting surface states but an insulating interior. Various BiSb alloys are also used in low-temperature thermoelectric devices. The presented measurement was conducted on a thermally evaporated Bi87Sb13 thin film.

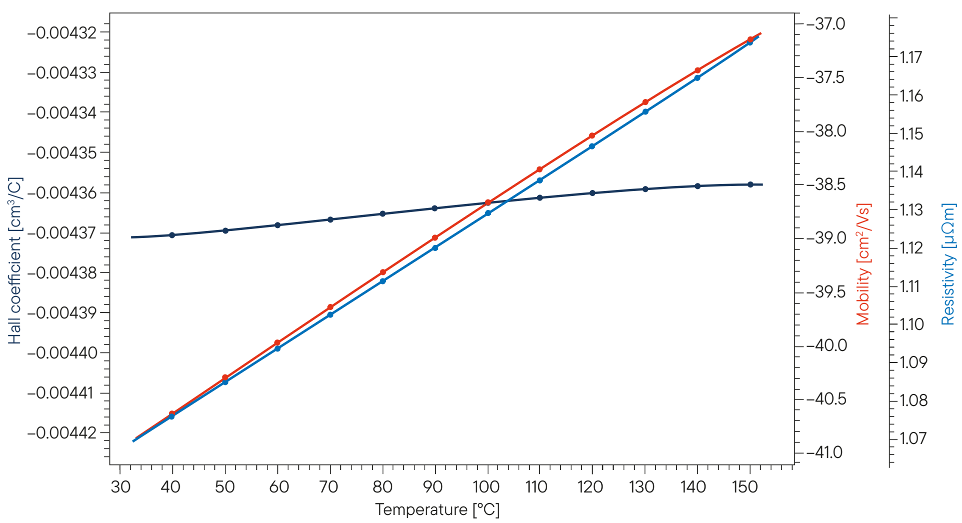
N-type gallium nitride (1µm) up to 600 °C



A 1 µm thick n-type gallium nitride (GaN) layer was characterized from room temperature up to 600 °C using the HCS L36 *Basic*.

The temperature dependent Hall coefficient shows a continuous increase followed by a stable plateau at higher temperatures, demonstrating reliable and reproducible measurements across the entire temperature range.

ITO (Indium tin oxide) up to 200 °C



Indium tin oxide (ITO) is a transparent conducting oxide (TCO) widely used in displays, touchscreens and photovoltaic devices. It combines high electrical conductivity with excellent optical transparency, making it an ideal material for optoelectronic applications. The sputter-deposited ITO film was characterized using the LINSEIS HCS L36 *Basic* over a temperature range from RT to 200 °C.

Double layer CuNi & Ti (300+60 nm) - HCS Basic vs. Advanced

A CuNi/Ti bilayer thin film (300 nm CuNi + 60 nm Ti) was characterized from room temperature to 200 °C using both the **LINSEIS HCS Basic** and the **LINSEIS HCS Advanced**.

Temperature-dependent measurements of the **Hall coefficient** and **carrier mobility** show excellent agreement between the two systems across the entire temperature range.

The results demonstrate that the **HCS Basic** offers reliable and highly reproducible Hall characterization for routine materials analysis, while the **HCS Advanced** builds on this proven performance and features an expanded range of functions for more demanding research applications and advanced electrical characterization. This ensures full compatibility of the measurement methods and reliability in data exchange between the two platforms.

- Direct comparison of HCS Basic and HCS Advanced
- CuNi/Ti bilayer thin film (300 nm + 60 nm)
- Temperature range: room temperature to 200 °C
- Determination of electrical resistivity, Hall coefficients, and charge carrier mobility
- Excellent agreement between both instruments
- Seamless transition from routine measurements to demanding research applications

Contract Testing

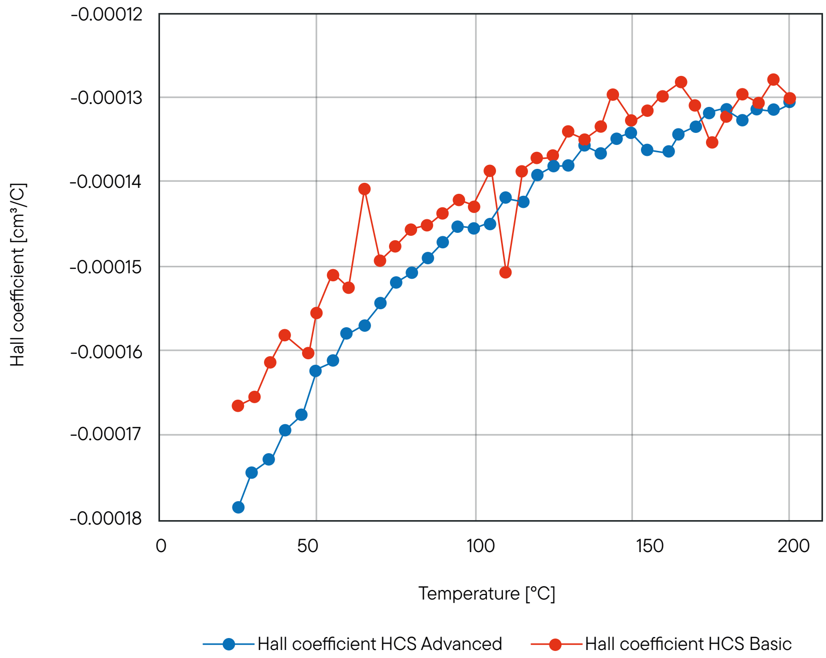


Fig. 1: Hall coefficient HCS Advanced/Basic

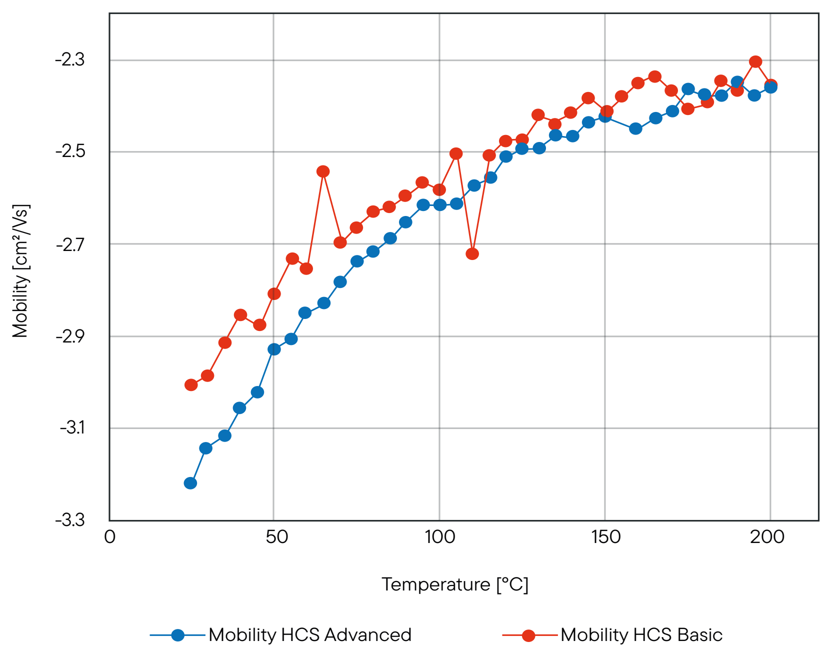


Fig. 2: Mobility HCS Advanced/Basic

Contract Testing

Repeating measurements of Silicon-germanium (500 µm) at RT

A **500 µm silicon-germanium (SiGe) sample** was repeatedly characterized at room temperature using the LINSEIS HCS Basic and HCS Advanced. Indium contact pads were used to **ensure stable electrical contacting and minimize contact-related influences.**

The repeated carrier mobility measurements demonstrate the different levels of measurement stability. While the HCS Basic provides reliable results for routine Hall characterization, the **HCS Advanced shows significantly reduced data scatter** and a **more stable measurement** signal over time.

	HCS Basic	HCS Advanced
Standard deviation σ - Carrier mobility	7.50 $cm^2/(V{\cdot}s)$	1.43 $cm^2/(V{\cdot}s)$

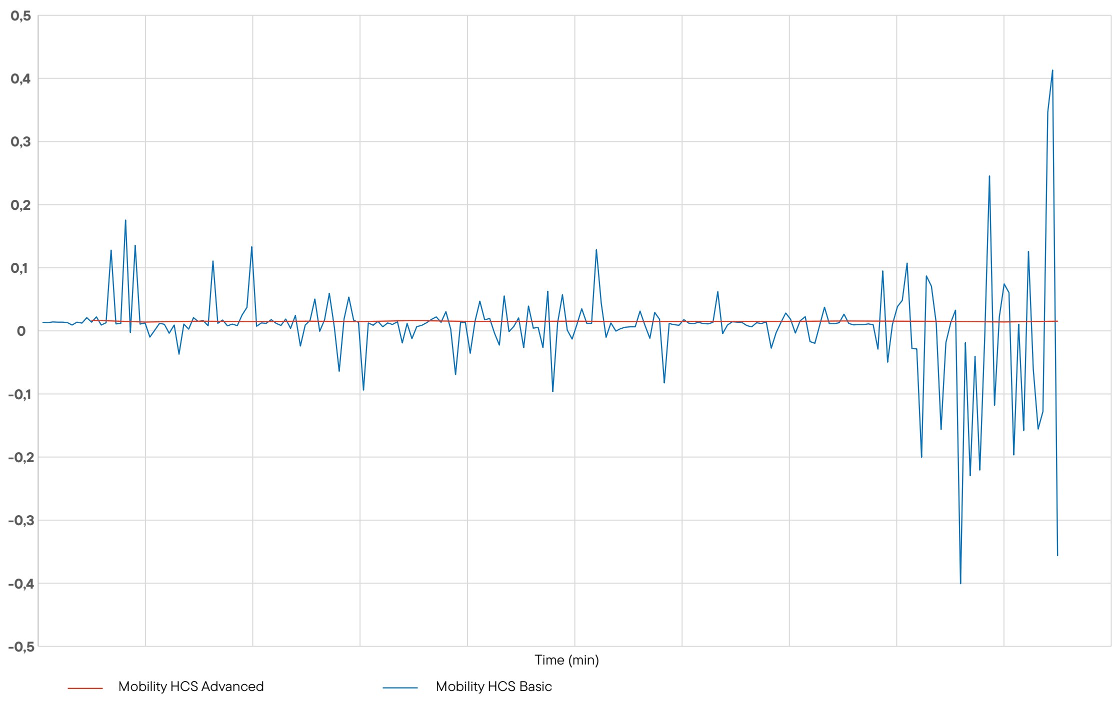


Fig. 3: Carrier Mobility HCS Advanced/Basic using Indium clamping contacts

Why Indium Contact Pads?

Reliable Hall measurements require a stable and reproducible electrical contact between the sample and the measurement electrodes. Indium is particularly suitable for this purpose due to its soft and ductile nature, allowing the contact material to conform closely to the sample surface.

This creates a stable electrical interface and helps minimize contact-related variations during repeated measurements.

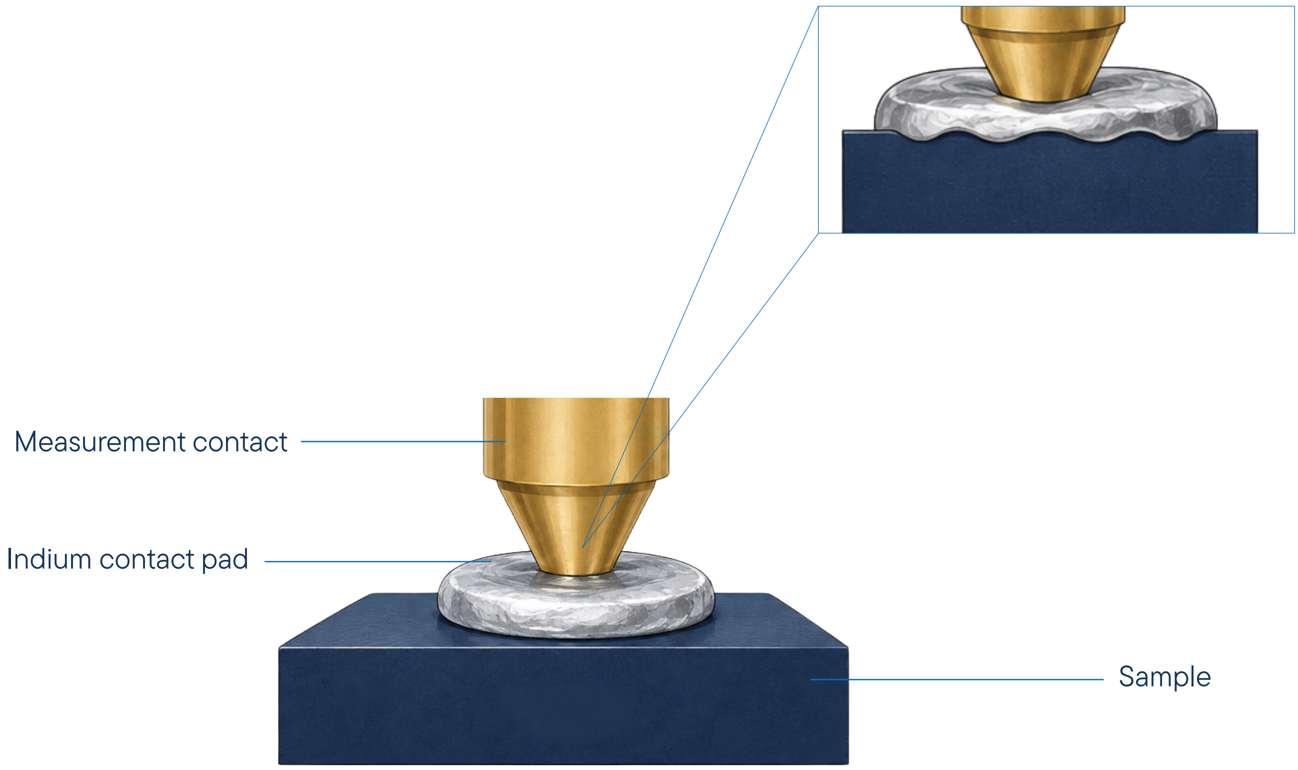


Fig. 4: Schematic illustration of a measurement using indium

pushing boundaries

LINSEIS GmbH Germany

Vielitzerstr. 43
95100 Selb

Tel.: (+49) 9287 880 0
E-mail: info@linseis.de

LINSEIS Inc. USA

109 North Gold Drive
Robbinsville, NJ 08691

Tel.: (+1) 609 223 2070
E-mail: info@linseis.com

LINSEIS China

Kaige Scientific Park
Room 120, Building T3,
No.1220 Yuqiao Road, Pudong,
Shanghai

Tel.: (+86) 61 90 12 03
Tel.: (+86) 50 55 06 42
E-mail: info@linseis.com.cn

LINSEIS India

Plot 65, 2nd Floor, Sai Enclave,
Sector 23, Dwarka05-800
110077 New Delhi

Tel.: +91-11-42883851
E-mail: sales@linseis.in

WWW.LINSEIS.COM

Follow us on LinkedIn Linseis Thermal Analysis