

Full Line Catalog

for Thermal Desorption Spectrometer

Slogan :

“Shaping tomorrow’s materials
through precision analysis”

We deliver **unparalleled precision and reliability** through our advanced mass spectrometry and thermal desorption analysis technologies.

By serving the **Semiconductor, Steel, FPD and advanced materials industries**, we reveal the invisible truths hidden within materials.

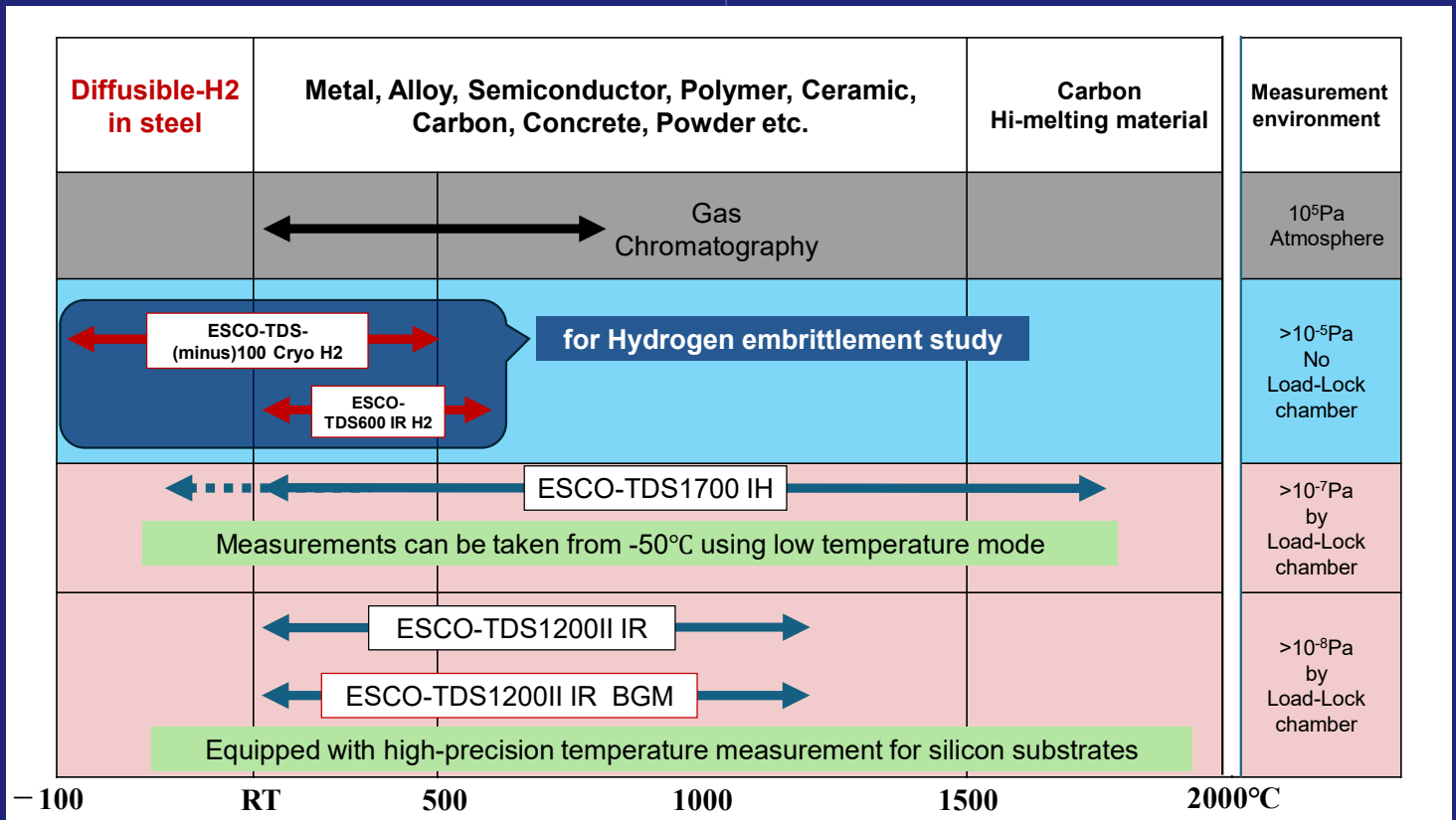
Leveraging our proprietary innovations—**ultra-high vacuum sensitivity, targeted sample heating, direct temperature control, and precise calibration algorithms**—

We contribute to technological breakthroughs and help build a safer and more sustainable future.

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ESCO-TDS Lineup



ESCO-TDS1200II IR



ESCO-TDS1700 IH



ESCO-TDS600 IR H2



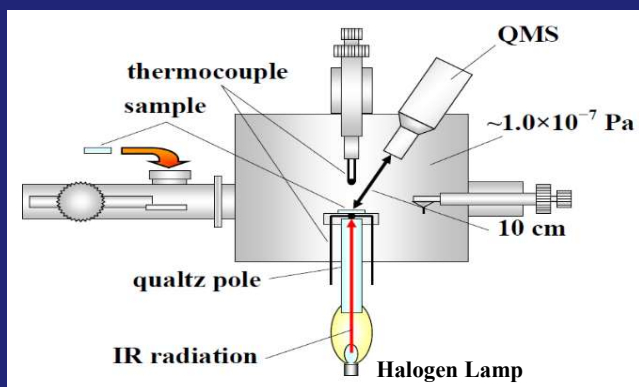
ESCO-TDS1200II IR PKG

Thermal Desorption Spectrometer ESCO-TDS1200II IR



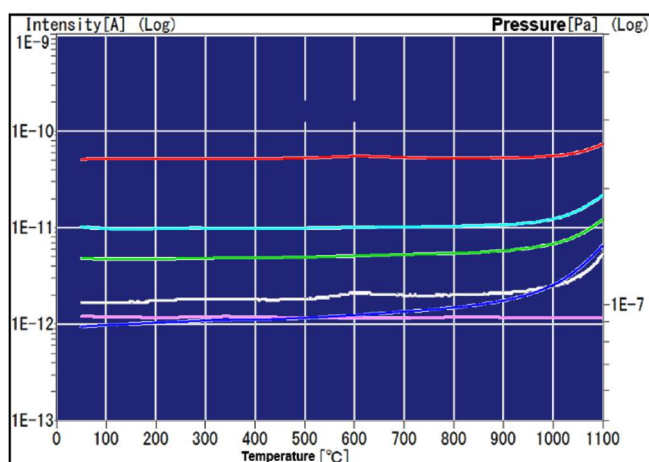
Underlying technology of ESCO-TDS1200II IR

Structural drawing of Measurement chamber



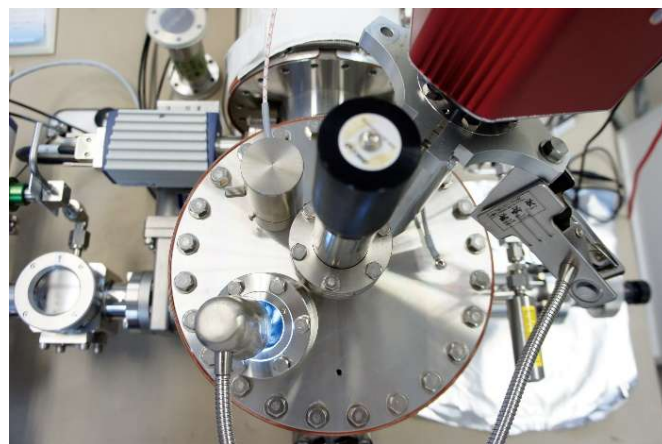
Infrared heating method

ESCO-TDS1200II IR directly heats the sample using infrared radiation delivered through a quartz rod. This method minimizes background noise even at high temperatures, allowing for high-sensitivity measurements.



QMS ionization position

To detect the desorbed gases with high sensitivity, a QMS ionization chamber is placed directly above the sample, enabling highly sensitive detection of even materials like metals that become easily deposited and organic molecules with a high molecular weight.



Load-lock chamber

The load-lock chamber is essential for achieving high sensitivity and high throughput measurement. ESCO-TDS1200II IR is equipped with a load lock chamber as standard. The sample is set in the load lock chamber, the load lock chamber is evacuated, and when the pressure drops to 10^{-4} Pa (within 3 min.), the dividing valve that separates the load lock chamber from the main vacuum chamber is opened and the sample is transferred to the main vacuum chamber.

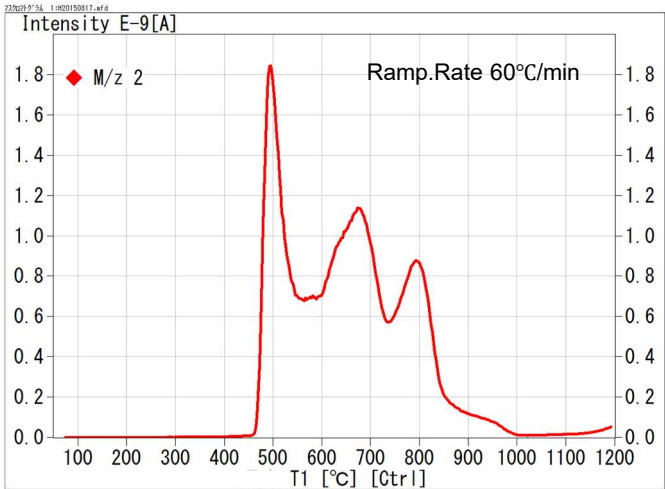


NIST-traceable sensitivity calibration standard sample

The standard samples we provide have been calibrated for amount of gas desorption using the standard leaks recommended by the U.S. National Institute of Standards and Technology (NIST). It has also been confirmed to be in good agreement with the results of calibrated standard leaks based on the standards of the Japanese national institute AIST.



Hydrogen ion implantation standard samples



TDS spectra of hydrogen (H₂) from hydrogen ion implanted standard samples

N. Hirashita and T. Uchiyama, "Quantitative desorption analysis of ultra large scale integration materials by thermal desorption spectroscopy," *Bunseki Kagaku*, vol. 43, no. 10, pp. 757–764, 1994.

Original Quantitative Program of ESCO

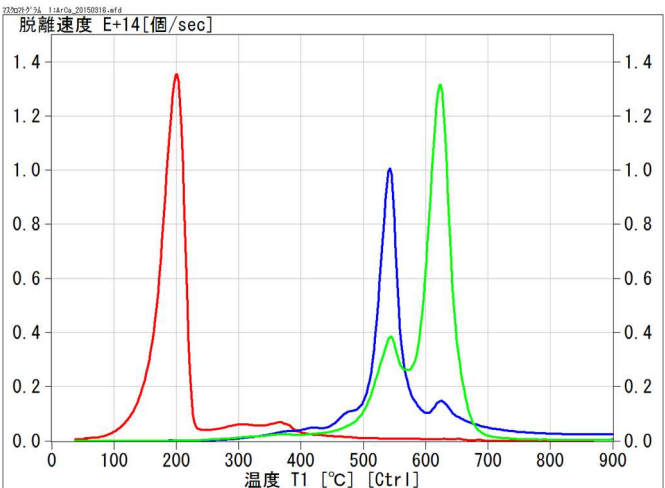
To quantitate desorbed gases, it is necessary to perform sensitivity calibration of the mass spectrometer in a timely manner. A common method of mass spectrometer sensitivity calibration is to use calibration standard leak gas cylinders, but this is expensive and time-consuming because it requires the preparation of the same number of cylinders as the type of gas to be quantified. In addition, when using calibration standard leak gas cylinders for toxic gases, health and safety management is also strictly required.

The desorbed gas quantification program that comes standard with the ESCO-TDS1200II IR enables sensitivity correction for all gas components by simply measuring a single NIST-traceable standard sample chip, using a sensitivity correction function that we have developed. Semi-quantitative determination of desorbed gas is possible quickly, easily, and safely compared to the method using a calibration standard leak gas cylinder.

	ESCO Method	Standard leak
H ₂ O	1.35x10 ¹⁷	1.40x10 ¹⁷
CO	1.12x10 ¹⁷	1.02x10 ¹⁷
CO ₂	1.64x10 ¹⁷	1.61x10 ¹⁷

Comparison of semi-quantitative values of water, carbon monoxide, and carbon dioxide desorbed from calcium oxalate monohydrate during thermal decomposition

Hirashita, N.; Urano, M.; Yoshida, H. Measurements of Outgassing Rates in a Field of Analysis. *Journal of the Vacuum Society of Japan*, 2014, 57(6), 214-218.

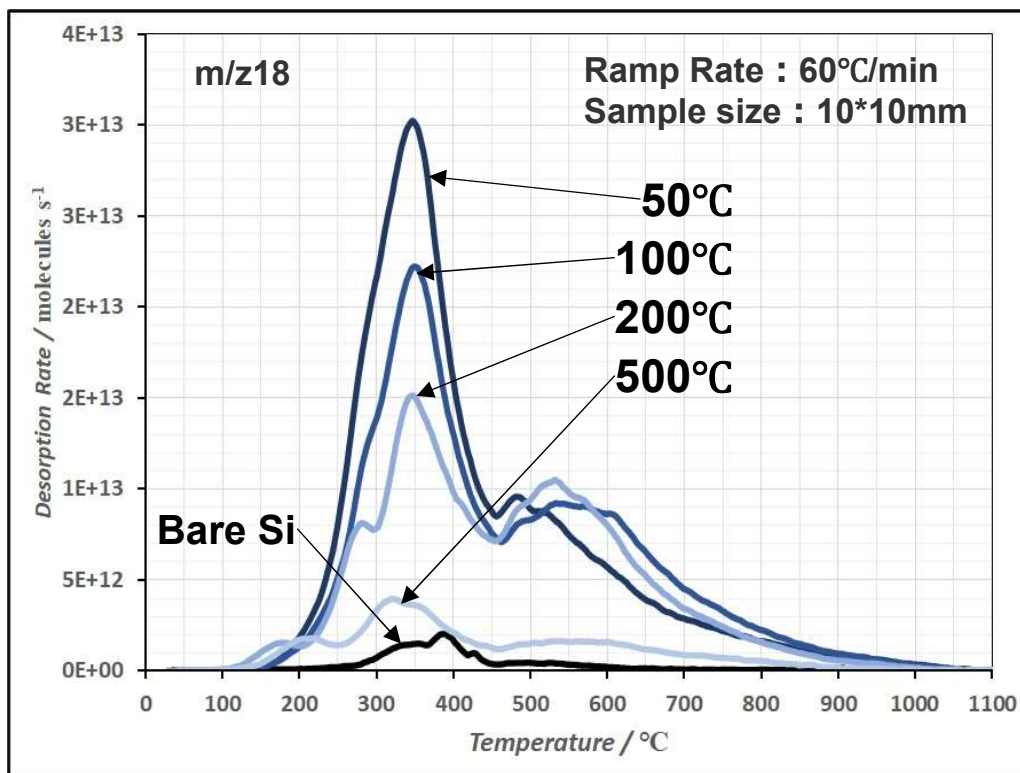


TDS spectra of Calcium Oxalate Monohydrate

Example of H₂O measurement of SiO₂ thin film (20nm) deposited by PEALD※

※ Plasma Enhanced Atomic Layer Deposition

The relationship between the deposition temperature and the amount of H₂O incorporated into a 20 nm thick SiO₂ film deposited by the PEALD method was evaluated. As shown in the figure below, the lower the deposition temperature, the higher the amount of H₂O incorporated into the SiO₂ film.

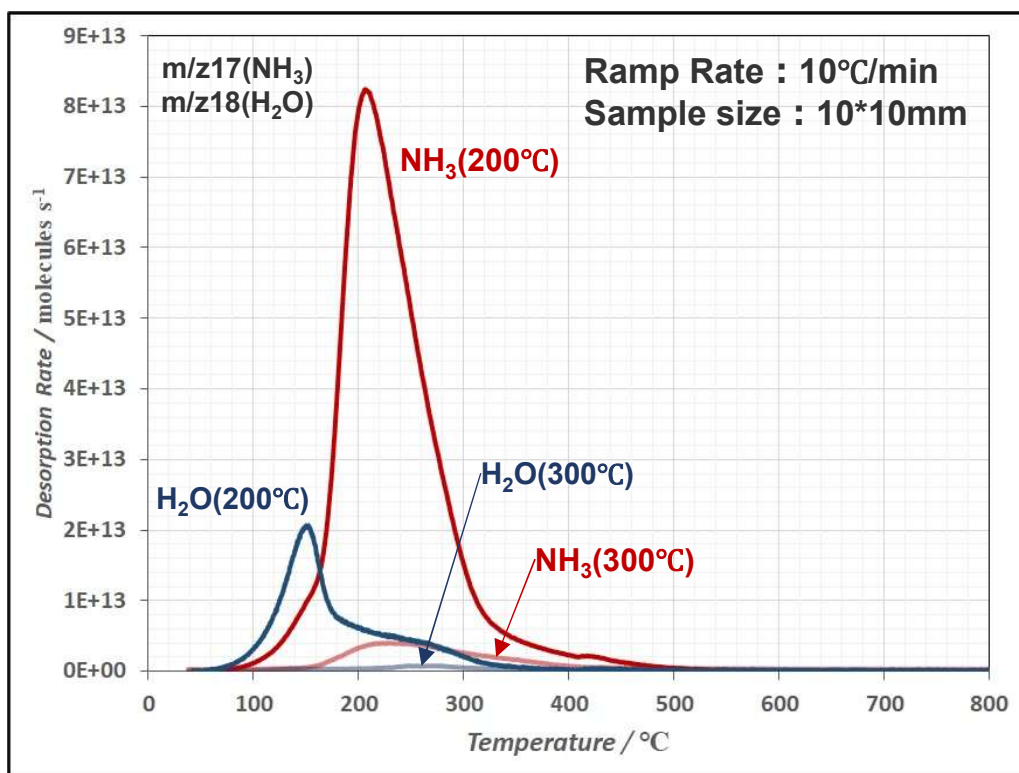


Deposition temp.	Amount of H ₂ O desorption [molecules]
– (Bare Si)	6.13E+14
50°C	6.71E+15
100°C	5.92E+15
200°C	5.06E+15
500°C	1.53E+15

Example of H₂O & NH₃ measurement of SiN thin film (250nm) deposited by PECVD※

※ Plasma Enhanced Chemical Vapor Deposition

The relationship between the deposition temperature and the amount of H₂O and NH₃ incorporated into a 250 nm thick SiN film deposited by the PECVD method was evaluated. As shown in the figure below, the lower the deposition temperature, the higher the amount of H₂O and NH₃ incorporated into the SiN film.



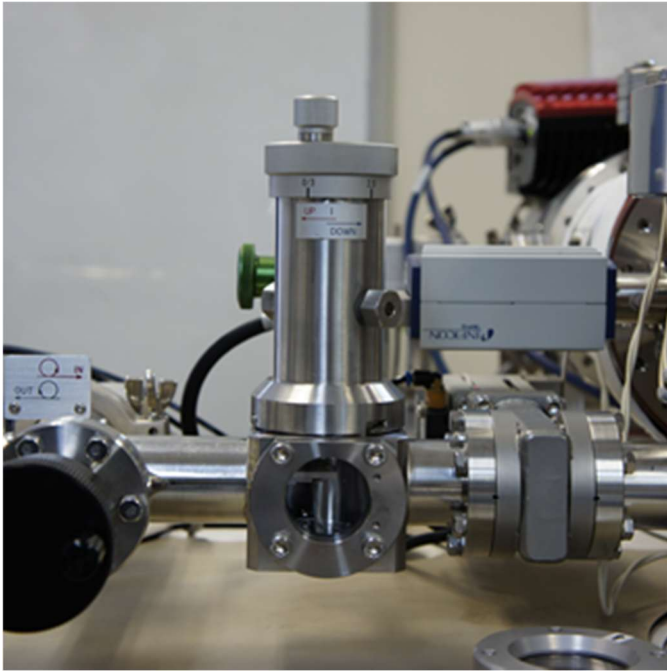
Deposition temp.	Amount of desorption [molecules]	
	H ₂ O	NH ₃
200°C	1.00E+16	4.73E+16
300°C	9.44E+14	3.34E+15

ESCO-TDS1200II IR H/W Option

Transfer Vessel

A mechanism to load the TDS sample prepared in a controlled environment such as a glove box into the TDS load lock chamber without exposure to the atmosphere.

For example, it is useful for the evaluation of cathode materials of lithium-ion batteries, which react violently with the atmosphere.



QMS manifold

Metal deposition on the QMS detection section is reduced, preventing deterioration of QMS sensitivity.

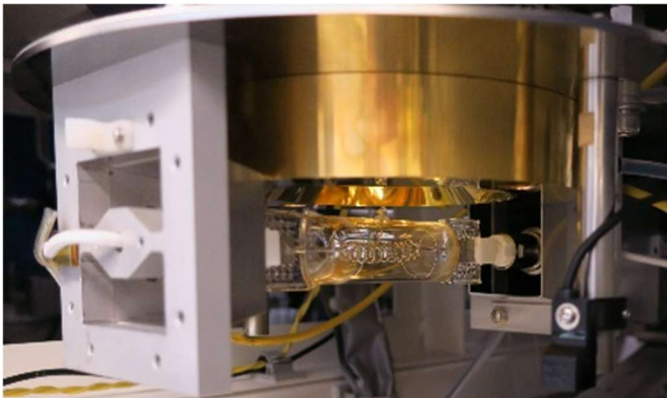
Installation of a liquid nitrogen cooling shroud also makes it possible to measure the hydrogen content in steel with even higher accuracy. Combined with a QMS equipped with a grid ion source, it is resistant to contaminant gases and always analyzes in an ideal gas ionization environment.



2kW Heating Unit

This heating source can be equipped with 2kW halogen lamps. The upper temperature limit of 1200°C of the standard heating source (1kW halogen lamp) can be raised to 1400°C.

This heating source is effective for the measurement of SiC single-crystal wafers and GaN single-crystal wafers, which are semiconductor materials that transmit infrared rays and are difficult to heat to high temperatures due to their low heating efficiency.



Slow gas purge

A mechanism that purges nitrogen gas into the load lock chamber without scattering powder samples. Powder samples, which are difficult to measure with vacuum equipment, can be measured without stress.



Technical Data of ESCO-TDS1200II IR

Max sample size	15 × 15 × 4 mm
Sensitivity	1 × 10 ¹¹ molecules/s (Ar)
Repeatability	< 5% (2σ, 1 day)
Main chamber	
Gas detector	Quadrupole mass spectrometer Range : 1 ~ 199 Da Resolution: (M/ΔM) ≥ M
Pressure gauge	BA-Pirani combination gauge Measurement range: 5 × 10 ⁻⁸ ~ 1 × 10 ⁵ Pa
Temperature measurement	Stage build-in thermocouple (Type C) Sample-contacted thermocouple (Type C) (option: Infrared thermometer)
Vacuum pump	Turbomolecular pump (400 L/s) Rotary Pump (200 L/min) (option: Dry pump)
Chamber	Internal volume: 10 L Ultimate pressure: ≤ 5 × 10 ⁻⁷ Pa
Load-Lock chamber	
Pressure gauge	Cold cathode – Pirani combination gauge Range : 1 × 10 ⁻⁷ ~ 1 × 10 ⁵ Pa
Vacuum pump	Turbomolecular pump Rotary pump (option: Dry pump)
Chamber	Internal volume: 1 L Valve: CF2.75" UHV gate valve
Temperature Control	
Temperature range	< 50 ~ 1200°C
Heating rate	1°C/min ~ 180°C/min
Max temperature program	100 steps
Heat Source:	IR light guide 1 kW halogen lamp (option: 2 kW lamp)
Software	
Measurement program	Real-time monitoring of QMS intensity, time, pressure, and temperature Easy setup of QMS settings and Temperature program Automatic start/stop function for measurement (time, temperature, pressure)
View and Analysis program	Graph display and output (temperature, pressure, TDS spectrum, mass spectrum, 2D, 3D) Background correction (minimum value, spline, exponential, blank data) CSV output (time, temperature, pressure, QMS Intensity, desorption rate) Quantification (H ₂ , CH ₄ , H ₂ O, N ₂ , CO, O ₂ , CO ₂ , others)

Thermal desorption Hydrogen Analyzer
(Diffusible Hydrogen Analyzer in Steel)

ESCO-TDS600 IR H2 ESCO-TDS-(minus)100 Cryo H2



ESCO-TDS600 IR H2
Product site



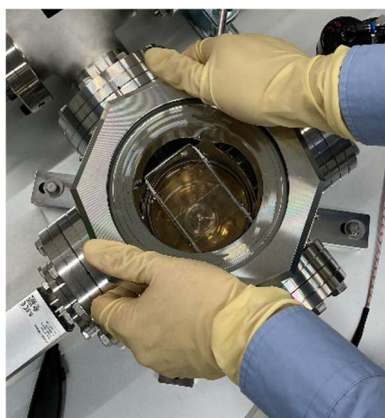
ESCO-TDS600 IR H2

Thermal desorption Hydrogen Analyzer (Diffusible Hydrogen Analyzer in Steel)

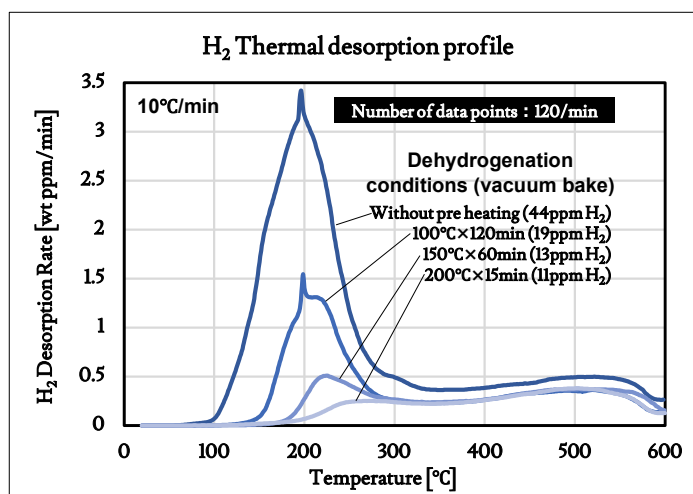
ESCO-TDS600 IR H₂ / ESCO-TDS-100 Cryo H₂

Easy measurement operation

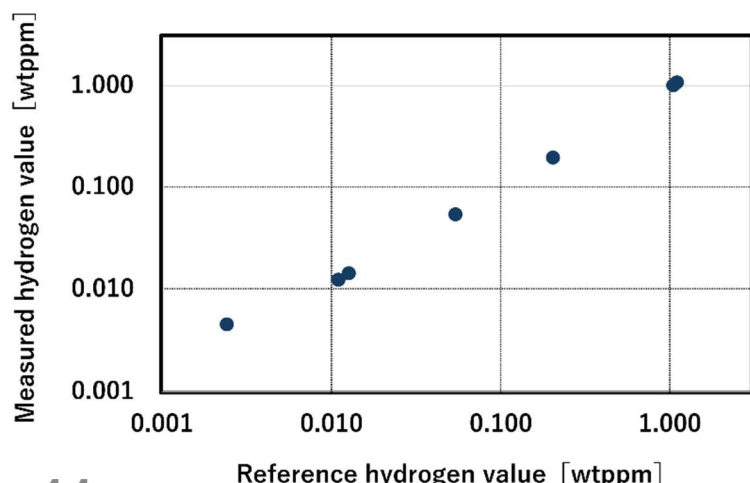
ESCO-TDS series is an ultra high vacuum type, but does not require sample transportation. Measurement can be started simply by placing the sample on the quartz stage in the sample heating chamber, closing the lid, and pressing the start button. It is designed to be easy to operate even for beginners.



Example of measurement of hydrogen in electroless Ni plating (5μm)



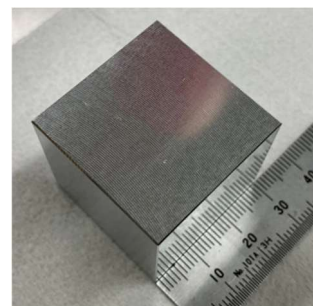
H₂ Calibration curve



Compatible with large samples

[One of the world's largest]

Can accommodate samples up to 30 x 30 x 30 mm. This sample size is among the largest for a temperature programmed hydrogen analyzer and can accommodate a wide variety of samples, allowing for flexible analysis.

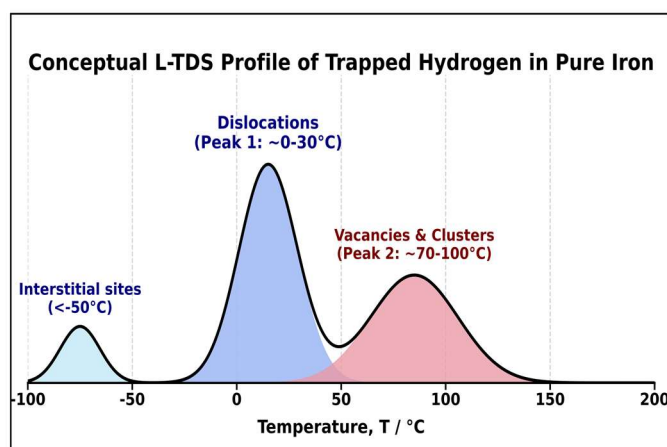


Low temperature measurement

[World's highest standard for commercial use]

The low-temperature measurement function currently under development will make it possible to separate and detect hydrogen trapped in iron lattice defects. This function is the world's first for a private company, and it is also one of the world's top-level technologies.

Model : ESCO-TDS-100 Cryo H₂



High-Speed Detection

ESCO-TDS series boasts a detection speed of once per second. This is 300 times faster than the detection speed of once every five minutes for other methods. By increasing the heating speed, measurements can be taken four times a day.

Detection of extremely low concentrations of hydrogen

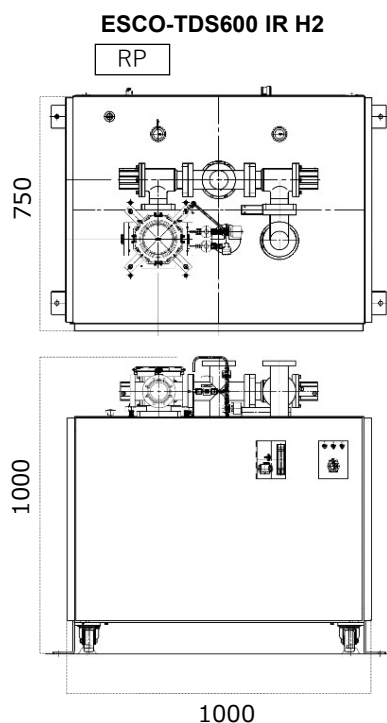
The ESCO-TDS series can detect hydrogen in the ppb (ng/g) or lower range thanks to its ultra-high vacuum technology, high sensitivity mass spectrometer, and large sample capacity.

Technical Data of ESCO-TDS600 IR H2 / ESCO-TDS-100 Cryo H2

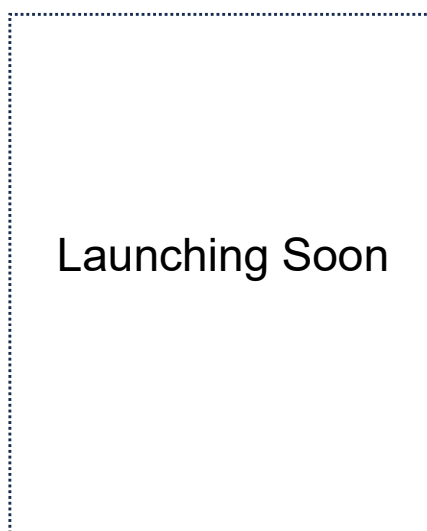
Spec sheet

	ESCO-TDS600 IR H2	ESCO-TDS-100 Cryo H2
Max sample size	30 × 30 × 30 mm	
H ₂ Sensitivity	ng/g(ppb)	
Main chamber		
Gas detector	Mass spectrometer Range : 2 ~ 4 Da	
Pressure gauge	BA-Pirani combination gauge Measurement range: $5 \times 10^{-8} \sim 1 \times 10^5$ Pa	
Temperature measurement	Stage build-in thermocouple (Type K)	
Chamber	Internal volume: 10 L · Ultimate pressure: $\leq 1 \times 10^{-6}$ Pa	
Temperature Control		
Temperature range	RT ~ 600°C	—(minus)100°C ~ 500°C
Heating rate	0.5°C/min ~ 180°C/min	
Max temperature program	100 steps	
Heat Source:	1 kW halogen lamp	
Software		
Measurement program	Real-time monitoring of m/z 2, 3 and 4 intensity, time, pressure, and temperature Easy setup of Mass spectrometer settings and Temperature program Automatic start/stop function for measurement (time, temperature, pressure)	
View and Analysis program	Graph display and output (time, temperature, pressure, m/z 2, 3 and 4 intensity) Background correction (minimum value, spline, exponential, blank data) CSV output (time, temperature, pressure, m/z 2, 3 and 4 intensity, desorption rate)	

Dimensions



ESCO-TDS-100 Cryo H2





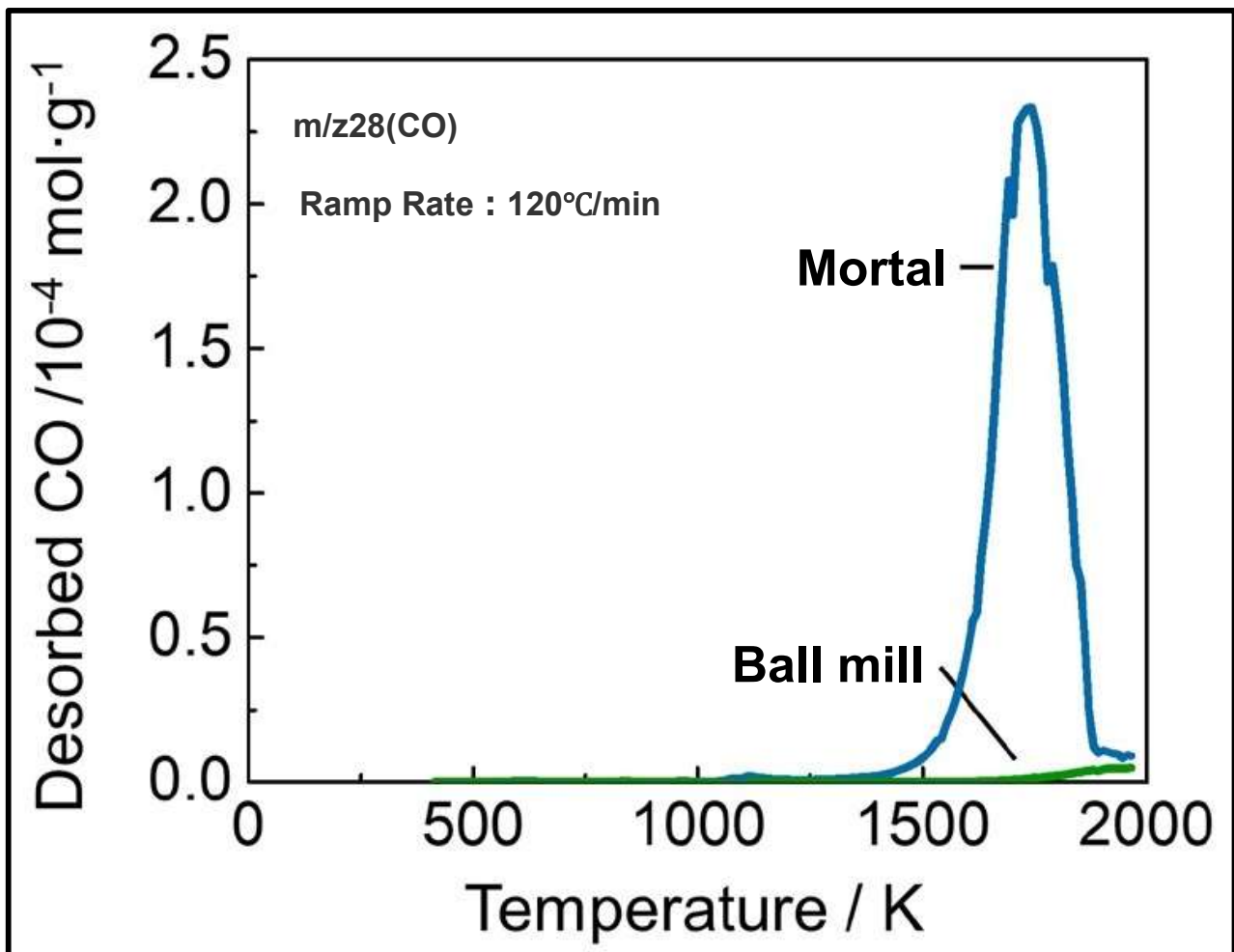
**Ultra-high temperature
Thermal Desorption Spectrometer**

ESCO-TDS1700 IH



An example of evaluating the effect of different TiC particle preparation methods on CO (carbon monoxide) desorption behavior

In mortar milled TiC particles, a clear CO desorption peak was observed in the high temperature region, indicating a large amount of CO desorption. This suggested that it was caused by contamination and impurities on the particle surface and grain boundaries, which contributed to the generation of bubbles. On the other hand, the ball-milled TiC particles showed less CO desorption and were confirmed to be a higher quality material.



Adapted from C. Hanada et al., *Int. J. Microgravity Sci. Appl.*, 40(3) 400301 (2023), <https://doi.org/10.15011/jasma.40.400301> (CC BY 4.0), with additions.

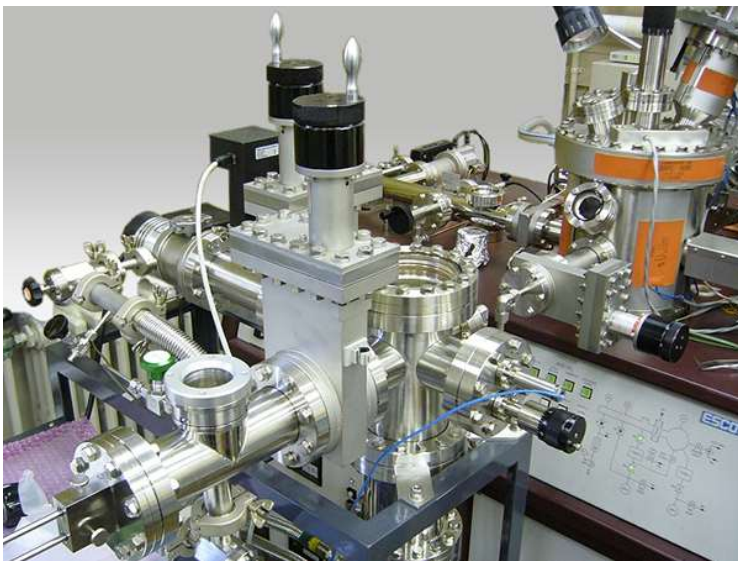
Technical Data of ESCO-TDS1700 IH

Max sample size	Diameter 20mm x Length 40mm
Sensitivity	1×10^{11} molecules/s (Ar)
Repeatability	< 5% (2σ , 1 day)
Main chamber	
Gas detector	Quadrupole mass spectrometer Range : 1 ~ 199 Da Resolution: $(M/\Delta M) \geq M$ A liquid nitrogen cooling shroud can be attached.(option)
Pressure gauge	BA-Pirani combination gauge Measurement range: $5 \times 10^{-8} \sim 1 \times 10^5$ Pa
Temperature measurement	Sample-contacted thermocouple (Type K) & Infrared thermometer
Vacuum pump	Turbomolecular pump (400 L/s) Rotary pump (200 L/min) (option: Dry pump)
Chamber	Ultimate pressure: $\leq 1 \times 10^{-6}$ Pa
Load-Lock chamber	
Pressure gauge	Cold cathode – Pirani combination gauge Range : $1 \times 10^{-7} \sim 1 \times 10^5$ Pa
Vacuum pump	Turbomolecular pump Rotary pump (option: Dry pump)
Chamber	Internal volume: 1 L Valve: CF4.5" UHV gate valve
Temperature Control	
Temperature range	Low temp. mode : – (minus)50~800°C High temp. mode : RT~1700°C or higher
Heating rate	1°C/min~180°C/min
Max temperature program	100 steps
Heat Source:	High Frequency Power Supply (45kHz)
Software	
Measurement program	Real-time monitoring of QMS intensity, time, pressure, and temperature Easy setup of QMS settings and Temperature program Automatic start/stop function for measurement (time, temperature, pressure)
View and Analysis program	Graph display and output (temperature, pressure, TDS, mass spectra, 2D, 3D) Background correction (minimum value, spline, exponential, blank data) CSV output (time, temperature, QMS Intensity, desorption rate) Quantification (H_2 , CH_4 , H_2O , N_2 , CO , O_2 , CO_2 , others)

Made-to-order

In addition to TDS analyzers, ESCO also manufactures custom-designed analyzers. The technologies common to all instruments are “**ultra-high vacuum**,” “**heating**,” “**mass spectrometry**,” “**ultra-trace analysis**,” and “**quantitative analysis**”. ESCO uses these five technologies to provide analytical instruments that are unparalleled in the world.

Cryogenic TDS System for Diffusible Hydrogen Analysis in Steel



It can raise the temperature of pure iron and steel specimens of 0.5 mm or less in thickness from -200°C or less to 400°C. It is a powerful tool for the precise analysis of hydrogen incorporated into lattice defects, which is said to be the cause of hydrogen embrittlement in steel. This system is equipped with a special closed helium gas circulating cryostat, which also allows for long-term temperature holding control.

NAGUMO, Michihiko, et al. *Fundamentals of hydrogen embrittlement*. Singapore: Springer, 2016.

Moisture and residual gas analyzer in sealed micropackages (Internal Vapor Analysis)

This device has an IVA function connected to the main body of the ESCO-TDS 1200II IR. The IVA function can measure the content of water vapor and other gases inside tiny devices encapsulated in ceramics, metals, glass, etc. The main targets of the IVA function are electronic devices (compound semiconductors, laser diodes, crystal oscillators, SAW filters, etc.) and lamps. It also shares the same gas detection unit with the ESCO-TDS1200II IR.

For example, thin-film materials used in the front-end process of semiconductor manufacturing can be evaluated with the TDS function, and gases contained in semiconductor devices after packaging in the back-end process can be analyzed with the IVA function.



ESCO-TDS1200II IR PKG

Contract Measurement Services

In addition to manufacturing and selling TDS instrument, we offer contract measurement services. As a dedicated TDS manufacturer, we leverage our deep technical expertise to help you solve complex material challenges. Our analyses are conducted on state-of-the-art instrument, meticulously maintained and operated by our team of experienced professionals, ensuring you receive the highest quality data for your research and development.

Equipment line for the measurement services

1. ESCO-TDS-1200II IR
2. ESCO-TDS-1200II IR BGM
3. ESCO-TDS1700 IH
4. ESCO-TDS-(minus)100 Cryo H2 (Launching Soon)



TDS Analytical Services
Inquiry Form

Measurement Examples

Semiconductors & Electronics:

Outgassing analysis of Oxide, Nitride, and Metal thin films
Quantification of hydrogen and water in oxide semiconductors (e.g., IGZO)
Moisture content analysis in thin films for OLED and LCDs
Analysis of residual components on wafer surfaces

Metals & Advanced Materials:

Analysis of diffusible hydrogen in steel
Hydrogen embrittlement analysis in plating films

Joining & Sealing Materials:

Analysis of absorbed and trapped gases in solder and sealants

Carbon Materials:

Functional group characterization
Outgassing analysis of carbon-based furnace components

Polymers & Organics:

Thermal desorption analysis of organic materials (e.g., Polyimide)
Thermal decomposition analysis of polymers (e.g., PMMA, Phenolic resins)

Ceramics & Glass:

Analysis of dissolved gases in glass and ceramic materials
High-temperature outgassing analysis of ceramic components

Our Service Process

STEP1: Consultation & Quotation

Contact us via our inquiry form or email with your measurement objectives and sample details (e. g., material, dimensions). We will review your requirements and provide a formal quotation.

sales@escoltd.co.jp

STEP2: Order & Scheduling

To proceed, please submit a purchase order (PO).

Once your order is confirmed, we will work with you to schedule the measurement date.

(Estimated lead time: approx. 1 month)

STEP3: Sample Shipment

Please ship your samples to our facility to arrive at least one business day prior to the scheduled measurement.

STEP4: Measurement & Reporting

We will perform the measurement and deliver a comprehensive report, typically within one week of the measurement date.

A Note on Sample Return:

The client is responsible for all costs associated with return shipping, including shipping fees, customs duties, and taxes.

Major Customers

Japan

Universities and research institutes	Semiconductors and electronic devices
Kyushu University	SONY
National Institute for Materials Science	Canon
Osaka University	Panasonic Holdings Corp.
Sophia University	TDK Corp.
Kumamoto University	OKI
Hiroshima University	Tokyo Electron (TEL)
Tohoku University	Renesas Electronics
Institute of Science Tokyo	Rapidus
University of Tokyo	Mitsubishi Electric Corp.
Yokohama National University	Murata Manufacturing Co., Ltd.
University of Tsukuba	Fuji Electric Co., Ltd.
National Institute of Advanced Industrial Science and Technology	Taiyo Yuden Co., Ltd.
Nagoya University	Iron and metals
FPD (Flat Panel Display)	Kobe Steel
JSR	Daido Steel Co., Ltd.
SHARP	The Japan Steel Works, Ltd.
Tokyo Visual Solutions	Analysis and testing organizations
Mitsubishi Gas Chemical Co., Ltd.	Nippon Steel Technology
AGC Inc.	Toshiba Nanoanalysis
Denka Co., Ltd.	Toray Research Center
Zeon Corporation	DNP Scientific Analysis Center, Inc.
Energy	Mitsui Chemical Analysis and Service Center, Inc.
Tokyo Gas Co., Ltd.	Oki Engineering Co., Ltd.

Overseas

Universities and research institutes		FPD (Flat Panel Display)	
Ulsan National Institute of Science and Technology (UNIST)	Korea	Sumika Technology Co., Ltd.	Taiwan
Korea Research Institute of Standards and Science (KRISS)	Korea	AUO	Taiwan
Semiconductors and electronic devices		INNOLUX CORPORATION	Taiwan
SK Hynix	Korea	Taiwan Toyo Advanced Technology Co., Ltd.	Taiwan
Shanghai Integrated Circuit Research and Development Technology Co., Ltd.	China	CHIMEI	Taiwan
		Samsung Display Co., Ltd.	Korea
		LG Display Inc	Korea
		JSR (Shanghai) Co., Ltd.	China

Company Outline

Company name	ESCO, Ltd.
Address	Oak Bldg 3F, 1-3-12 Nishikubo, Musashino, Tokyo 180-0013, JAPAN
	(5 minute walk from the JR Mitaka station)
TEL	81-422-55-1011
FAX	81-422-55-1960

Company History

June 2025	Launched ESCO-TDS600 IR H2 and began the measurement services
April 2025	Launched Gas analysis system for internal PKG gas.
August 2023	Started development of ESCO-TDS600 IR H2 with 2023 Monodzukuri Subsidy.
May 2021	Became a wholly owned subsidiary of JTEC Corporation through acquisition.
April 2015	Released ESCO-TDS-1200II IR (CE marking compliant).
December 2011	Developed ESCO-TDS1700 IH (high-frequency heating type)
August 2005	Delivered MIL-spec custom system (Internal vapor analysis)
March 1999	Developed and released TDS1400
January 1995	Developed and released EMD-WA1000S
July 1994	Released EMD-WA1000K using QMS for the first time
July 1990	Delivered bulb gas analysis system to Harrison Electric
March 1990	Released wafer gas analysis system and delivered to Oki Electric
November 1986	Delivered mass spectrometer for semiconductor substrate to Hitachi
February 1984	Developed data processing system for QMS and delivered to JAEA
November 1980	Developed and commercialized GC-MS
June 1979	Commercialized new MS for liquid chromatography
November 1978	Started development of new mass spectrometer
July 1978	Company established



Corporate website



ESCO-TDS1200II IR
Product site



ESCO-TDS600 IR H2
Product site



Contact Us

Introduction of Research Papers Utilizing Our Thermal Desorption Spectrometer

- N. Hirashita, S. Tokitoh, and H. Uchida, "Thermal desorption and infrared studies of plasma-enhanced chemical vapor deposited SiO films with tetraethylorthosilicate," Japanese Journal of Applied Physics, vol. 32, no. 4R, pp. 1787, 1993.
- K. Onishi et al., "Temporary Direct Bonding by Low Temperature Deposited SiO₂ for Chiplet Applications," ACS Applied Electronic Materials, vol. 6, no. 4, pp. 2449-2456, 2024.
- K. Kobayashi, R. Miyauchi, and K. Kimoto, "Influence of high-temperature thermal annealing on paramagnetic point defects in silicon-rich silicon nitride films formed in a single-wafer-type low-pressure chemical vapor deposition reactor," Journal of Vacuum Science & Technology A, vol. 42, no. 5, 2024.
- T. Irisawa et al., "Physical understanding of strain-induced modulation of gate oxide reliability in MOSFETs," IEEE Transactions on Electron Devices, vol. 55, no. 11, pp. 3159-3166, 2008.
- K. Fukui et al., "Characteristic fast H⁻ ion conduction in oxygen-substituted lanthanum hydride," Nature Communications, vol. 10, no. 1, p. 2578, 2019.
- T. Chiba et al., "Preparation of an overall intergranular fracture surface caused by hydrogen and identification of lattice defects present in the local area just below the surface of tempered martensitic steel," Scripta Materialia, vol. 223, p. 115072, 2023.

This is a selection of research papers that have utilized our Thermal Desorption Spectrometer among many others. We sincerely appreciate the authors for their efforts and dedication in utilizing our Thermal Desorption Spectrometer .

ESCO, Ltd.

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<https://www.escotds.com/>