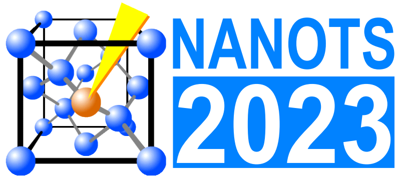


# The 43rd Annual NANO Testing Symposium

Senri Life Science Center
(Toyonaka, Osaka, Japan)

7–9 November 2023

http://www-NANOTS.ist.osaka-u.ac.jp/

NANOTS@ist.osaka-u.ac.jp

***Sponsored by*** The Institute of NANO Testing
***In cooperation with***

- The Institute of Electronics, Information and Communication Engineers
- The Japan Society of Applied Physics
- Reliability Engineering Association of Japan
- Union of Japanese Scientists and Engineers

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# 1 Location

Technical Sessions:

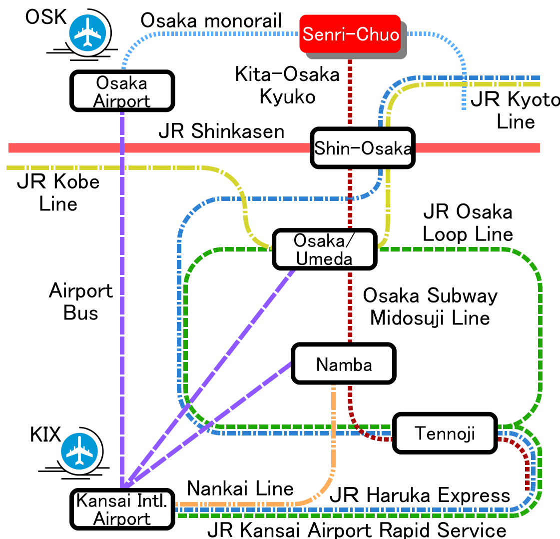
Life Hall, the 5th floor, Senri Life Science Center
1-4-2, Shin-Senri-Higashi-Machi, Toyonaka
Osaka, 560-0082 JAPAN
Phone: +81-6-6873-2010, FAX: +81-6-6873-2011

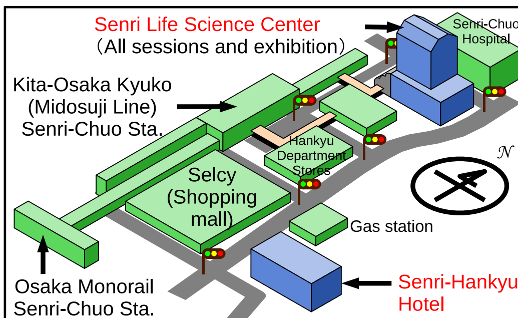
Exhibition:

Senri Room, the 6th floor, Senri Life Science Center

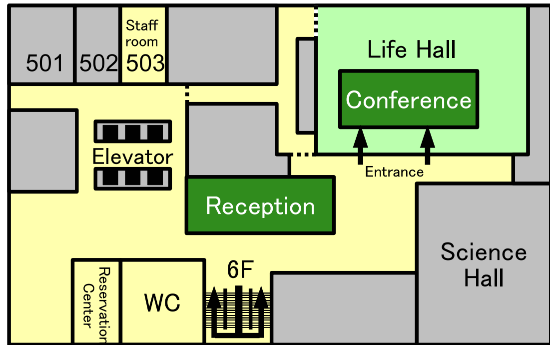
Evening Session:

Senri Hankyu Hotel
2-1, Shin-Senri-Higashi-Machi, Toyonaka
Osaka, 560-0082 JAPAN
Phone: +81-6-6872-2211, FAX: +81-6-6832-2161

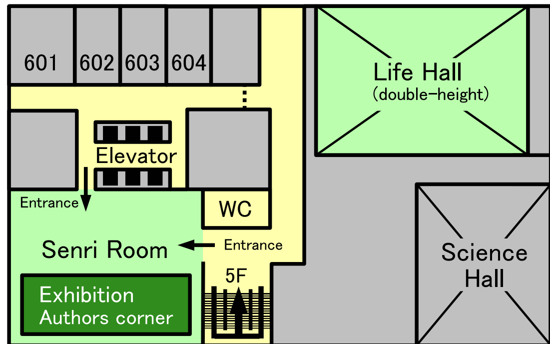


## 2 Floor Map




Senri Life Science Center 5F




Senri Life Science Center 6F

## 3 Invited Talk

The following invited talks will be given.

9:30–10:30, Tuesday, 7 November:

"Optical characterization and applications of deep ultraviolet AlGaN light-emitting diodes"
by Prof. Kazunobu Kojima, *Osaka University*

13:10–14:10, Tuesday, 7 November:

"Issues and Future Trend of Power Devices"
by Dr. Hidekazu Yamamoto, *Power Device Enabling Association*

9:30–10:30, Wednesday, 8 November:

"Recent progress on attosecond electron-beam technology"
by Dr. Yuya MORIMOTO, *RIKEN*

16:20–17:20, Wednesday, 8 November:

"The and future prospects and expectations for B5G and 6G"
by Prof. Takashi WATANABE, *Osaka University*

## 4 Tutorial Session

The following tutorial sessions will be given.

13:25–14:25, Thursday, 9 November:

"Analysis and Reliability Evaluation Methods Specific to Power Devices"
by Dr. Yutaka IKEMOTO, *Qualtec*

14:45–15:45, Thursday, 9 November:

"Development of Atom Probe Tomography for evaluation of semiconductor device"
by Dr. Norihito MAYAMA, *Toshiba Nanoanalysis*

## 5 Authors Corner

Authors corner, a place for audience to meet with and discuss with authors, will be given just after the sessions (except for commercial sessions) in Senri room on 6F.

## 6 Evening Session

Evening session of NANOTS is a special session for discussing on research trend around the world and the future perspective. The session will be held on 18:00–20:00, Wednesday, 8 November. (Senri Hankyu Hotel).

## 7 Exhibition and Commercial Session

The Symposium will feature the latest in service providers, equipment manufacturers and suppliers. A large exhibit floor will give the opportunity to key-vendors to represent the core business area in these fields. Furthermore, a commercial session will give the opportunity to introduce new products with short presentation.

## 8 Official Languages

The official languages of the symposium are Japanese and English. Papers included in the proceeding will be written in

Japanese or English. Papers in Japanese will have an abstract written in English. We will have no interpreter.

## 9 Registration Fee

| Course | Fee | Including |
|---|---|---|
| Non-student | JPY 13000 | All sessions, exhibition, and proceeding (download only) |
| Student | JPY 5000 | |

Please pay the fee by 27 October 2023 in one of the following ways.

Wire Transfer: Please send Japanese YEN (JPY) to the following account by wire transfer:

Bank Name: Resona Bank, Ltd.
SWIFT (BIC) Code: DIWAJPJT
Branch Name: Senri-Kita Branch
Branch Code: 222
Address: 4-2-D2-201, Furuedai, Suita, Osaka, 565-0874, Japan
Phone: +81-6-6872-0651
Account Number: 6843152
Account Name: The Institute of NANO Testing Nakamae Koji
Note: All bank charges JPY 5,000 (= the sending bank charge + the receiving bank charge) must be paid by the participant.

Credit card: Please clik "Pay Now" button after you finish on-line registration.

## 10 Symposium Registration

Please register on line by using our website: http://www-NANOTS.ist.osaka-u.ac.jp/ by 27 October 2023 (punctuality).

For preventing COVID-19 infections, this symposium is for pre-registration only, and we will not accept participation on the day. Thank you for your understanding.

## 11 Cancellation Policy

Cancellations must be submitted in an e-mail. Cancellations received by 17:00, 27 October 2023 (in Japan Standard

Time) are entitled to a refund minus an administrative fee (all bank charges plus a 10 % processing fee). No refunds will be given to registrants who cancel after 27 October 2023 or who fail to attend the event.

## 12 Accommodation Information

There is Senri Hankyu Hotel around the symposium site. The hotel is located close to the symposium site. You can go to the symposium site from the hotel by 5 minutes walk. If you want to stay at Senri Hankyu Hotel, please visit the hotel's web site and book a room. Please keep in mind that the reservation will be closed in the case all available rooms are booked.

http://www.senri-htl.co.jp/

## 13 Proceedings

Technical papers will be provided on electronic media (download). Download information will be announced on November 2, 2023. The conference program will be provided on print media.

## 14 Latest Information

You can find latest information on all aspects of NANOTS at http://www-NANOTS.ist.osaka-u.ac.jp/ .

## 15 Steering & Program Committee

**Chairman:**

| | |
|---|---|
| Koji NAKAMAE | (Osaka University) |

**Member:**

| | |
|---|---|
| Yasuo CHO | (Tohoku University) |
| Yasunori GOTO | (MIRISE Technologies) |
| Yasuhisa HIGUCHI | (Hitachi, Ltd.) |
| Kazunobu KOJIMA | (Osaka University) |
| Toru KOYAMA | (Fuji Electric Co., Ltd.) |
| Suigen KYOH | (Kioxia Corp.) |
| Hitoshi MAEDA | (Renesas Electronics Corp.) |
| Kiyoshi NIKAWA | (Device Evaluation Technology Lab.) |
| Yoichi OSE | (Hitachi High-Tech Corp.) |
| Hirotoshi TERADA | (Hamamatsu Photonics) |
| Masahiko TSUJITA | (Sony Semiconductor Manufacturing Corp.) |
| Yuichiro YAMAZAKI | (TASMIT Inc.) |

## 16 Secretariat

Yoshihiro MIDOH and Koji NAKAMAE
Secretariat of the Institute of NANO Testing
Miura Lab., Dept. Information Systems Engineering,
Grad. Sch. Information Science and Technology
Osaka University
1-5, Yamada-Oka, Suita, Osaka, 565-0871 JAPAN
Phone/Fax: +81-6-6879-7813 / +81-6-6879-7812
E-mail: NANOTS@ist.osaka-u.ac.jp
Web: http://www-NANOTS.ist.osaka-u.ac.jp/

## 17 Technical Program

### Tuesday, Nov. 7, a.m. / Life Hall

(1) Opening remarks
*9:20* K. Nakamae / Chairman, The Institute of NANO Testing

### Invited Talk I — a.m., Tue 7

*Chairman* Hirotoshi Terada

(I1) Optical characterization and applications of deep ultraviolet AlGaN light-emitting diodes
*9:30* K. Kojima / Grad. Sch. Engineering, Osaka Univ.

· · · · · · · · · · 10:30〜10:50 Authors corner & break · · · · · · · · · ·

## Photonics technology — a.m., Tue 7

*Chairman* Masahiko Tsujita

(2) *10:50* Physical properties evaluation of compound semiconductor wafers by PL imaging

K. Morishima[a], Y. Yokoyama[a], K. Ikemura[b], and T. Nakamura[b] / [a]Product Development Dept., Systems Div., Hamamatsu Photonics, [b]Business Planning Dept., Systems Div., Hamamatsu Photonics

(3) *11:15* Estimation of carbon concentrations in GaN crystal substrates based on photoluminescence spectroscopy

K. Sano[a], H. Fujikura[b], T. Konno[b], S. Kaneki[b], S. Ichikawa[a], and K. Kojima[a] / [a]Grad. Sch. Engineering, Osaka Univ., [b]IT-related Chemicals Research Lab., Sumitomo Chemical Co., Ltd.

(4) *11:40* Photoluminescence property of semiconductor package and non-luminescence material detection technique

K. Oota / LSI Solutions Div., Toshiba Information Systems (Japan) Corp.

· · · · · · · · · · 12:05〜12:25 Authors corner & break · · · · · · · · · ·

· · · · · · · · · · · · · · 12:25〜13:10 Lunch Break · · · · · · · · · · · · · ·

# Tuesday, Nov. 7, p.m. / Life Hall

## Invited Talk II — p.m., Tue 7

*Chairman* Toru Koyama

(I2) *13:10* Issues and future trend of power devices

H. Yamamoto / Power Device Enabling Association

· · · · · · · · · · 14:10〜14:30 Authors corner & break · · · · · · · · · ·

## Power Device Analysis I — p.m., Tue 7

*Chairman* Hitoshi Maeda

(5) *14:30* Study on utilization of SAT data in reliability testing of power semiconductors

Y. Take, M. Kato, Y. Kobayashi, and T. Nakazawa / Semiconductor Experiment Section2, MIRISE Technologies Co., Ltd.

(6) *14:55* Nanoscale fluctuation analysis on capacitance-voltage profiles of Al2O3/diamond by time-resolved scanning nonlinear dielectric microscopy

K. Yamasue[a], Y. Ogata[b], T. Matsumoto[c], N. Tokuda[c], and Y. Cho[d] / [a]Research Institute of Electrical Communication, Tohoku Univ., [b]Grad. Sch. Engineering, Tohoku Univ., [c]Nanomaterials Research Institute, Kanazawa Univ., [d]New Industry Creation Hatchery Center, Tohoku Univ.

(7) *15:20* Using Raman spectroscopy to measure local temperature in semiconductor devices

R. Sugie, T. Uchida, and K. Inoue / Toray Research Center

· · · · · · · · · · 15:45～16:05 Authors corner & break · · · · · · · · · ·

## Power Device Analysis II — p.m., Tue 7

*Chairman* Yasunori Goto

(8) *16:05* Time-resolved photoemission spectroscopy for surface-sensitive evaluation of carrier lifetime in (0001) InGaN film

S. Ichikawa[a], Y. Matsuda[b], H. Dojo[a], M. Funato[b], Y. Kawakami[b], and K. Kojima[a] / [a]Grad. Sch. Engineering, Osaka Univ., [b]Grad. Sch. Engineering, Kyoto Univ.

(9) *16:30* Quantitative evaluation of P/N junction using DPC/iDPC/dDPC

N. Nakanishi[a], H. Maeda[b], S. Sadayama[a], and Y. Kunimune[b] / [a]Nanoport Japan, Thermo Fisher Scieintific, [b]Analysis & Evaluation Technology Dept., Renesas Electronics Corp.

(10) *16:55* Analysis of compound semiconductors using low voltage scanning electron microscope with cathodoluminescence (CL)

Y. Nakajima[a], N. Asano[a], T. Ootsuka[a], S. Kamijo[a], K. Ikita[a], Y. Kubota[a], Y. Okano[a], M. Kawabata[b], and S. Asahina[a] / [a]Scanning System Business Operations, JEOL Ltd., [b]EDAX BU, AMETEK, Inc.

· · · · · · · · · · 17:20～17:40 Authors corner & break · · · · · · · · · ·

## Wednesday, Nov. 8, a.m. / Life Hall

### Invited Talk III — a.m., Wed 8

*Chairman* Koji Nakamae

(I3) *9:30* Recent progress on attosecond electron-beam technology
Y. Morimoto / RIKEN Cluster for Pioneering Research, RIKEN Hakubi Team Leader

· · · · · · · · · · 10:30〜10:50 Authors corner & break · · · · · · · · · ·

### Commercial Session — a.m., Wed 8

*Chairman* Yasuhisa Higuchi

(C1) *10:50* Development of non-destructive inspection method for solder voids and cracks using deep learning techniques
R. Ueki, M. Hasegawa, and M. Takahashi / Research & Development Dept., Qualtec Co., Ltd.

(C2) *10:57* Introduction for advanced nanoscale device characteristics analysis system
J. Fuse[a], T. Shimamori[a], Y. Wu[a], K. Shigeto[b], and M. Hijikata[c] / [a]Solution Development Dept., Hitachi High-Tech Corp., [b]Electron Microscope Systems Design Dept., Hitachi High-Tech Corp., [c]Business Planning for Beam Technology Systems Dept., Hitachi High-Tech Corp.

(C3) *11:04* Approach to LSI process diagnosis technique for 65nm and 45nm processes
E. Yagyu, K. Yabe, H. Tateyama, I. Murakami, Y. Yatagawa, K. Asai, and K. Takamori / Oki Engineering Co., Ltd.

(C4) *11:11* CAD navigation for sequential EOP: EASY-D
M. Nikaido / EDA Product Div., TOOL Corp.

(C5) *11:18* CAD-navigation system AZSA-HS
K. Konishi / Sales Gr, Astron. Inc.

(C6) *11:25* Introduction of deep-cooled InGaAs camera for hamamatsu iPHEMOS®-MPX inverted microscope.
M. Fujiwara, A. Kataoka, K. Kudo, S. Suzuki, T. Yamada, and Y. Kano / Business Promotion 3rd Dept. Systems Div., Hamamatsu Photonics K. K.

(C7) *11:32* Excillum' s microfocus X-ray tube technology for non-destructive submicron resolution
A. Nakano / Excillum

(C8) *11:39* 2D FTIR spectroscopic imaging system & zooming infrared microscope

Y. Nakashima[a], Y. Numajiri[a], and K. Hamada[b] / [a]Sales I Div., TOKI COMMERCIAL Co., Ltd., [b]Engineering Dept. SD Section, Nissin Machinery Corp.

(C9) *11:46* Nanoprobing SEM solution for in situ semiconductor failure analysis

Y. Nakayama[a], R. Claassen[b], and S. Ogawa[a] / [a]sales Dept., APOLLOWAVE Corp., [b]Imina Technlogies SA

(C10) *11:53* Introduction of photo emission and OBIRCH analysis service by applying high voltage

K. Inomata, H. Kawahara, and H. Tsukui / Evaluation Analysis Dept., Renesas Engineering Services Co., Ltd.

(C11) *12:00* Introduction of FIB-SEM system JIB-PS500i suitable for TEM lamellae preparation of semiconductor device

Y. Nakajima, M. Kadoi, and M. Shibata / EP Application Dept., EP Business Unit, JEOL Ltd.

(C12) *12:07* Introduction of multi-ion species DualBeam application

K. Murata[a] and A. Stokes[b] / [a]Electronics Sales Development, Thermofisher Scientific, [b]Electronics Business Development, Thermofisher Scientific

(C13) *12:14* Introduction of technology for structural analysis of semiconductors by ion milling

S. Aida[a], K. Horinouchi[a], and Y. Inagi[b] / [a]Electron Microscope Systems Design Dept., Hitachi High-Tech Corp., [b]Solution Development Dept., Hitachi High-Tech Corp.

(C14) *12:21* TENSOR, dedicated real-time 4D-STEM

N. Suzuki, T. Okawa, and Y. Kodama / Physics and Chemistry Measurement Div., TOYO Corp.

(C15) *12:28* Introduction of ZEISS sample in volume analysis

E. Maeda / Research Microscopy Solutions, Carl Zeiss Co., Ltd.

(C16) *12:35* Challenges in failure analysis and how plasma-therm solutions participate to improving the life of engineers and insuring reliable results

T. Lazerand[a], A. Uvarov[a], A. Pageau[a], H. Shibata[b], H. Saget[b], and M. Tanimura[b] / [a]Plasma-Therm Europe, [b]Plasma-Therm-Japan K. K.

·············· 12:42～13:35 Lunch Break ··············

## Wednesday, Nov. 8, p.m. / Life Hall

### Equipment and systems — p.m., Wed 8

*Chairman* Yoichi Ose

(11) *13:35* Efficient failure analysis using AI image generation

M. Uchida[a], K. Sugiyama[a], and K. Oota[b] / [a]Corporate Manufacturing Engineering Center, Toshiba Corp., [b]LSI Solutions Div., Toshiba Information Systems (Japan) Corp.

(12) *14:00* Fast ion species switching in gas field ionization ion sources and its applications

S. Matsubara[a], H. Shichi[a], and T. Hashizume[b] / [a]Nano-process Research Dept., Hitachi, Ltd., [b]Center for Exploratory Research, Hitachi, Ltd.

(13) *14:25* Improving passive voltage contrast with positive stage bias in scanning electron microscopy

N. Asano, K. Ikita, Y. Nakajima, and S. Asahina / Scanning system business operations, JEOL Ltd.

· · · · · · · · · · 14:50～15:10 Authors corner & break · · · · · · · · · ·

### Fault Localization — p.m., Wed 8

*Chairman* Kiyoshi Nikawa

(14) *15:10* Enhancing imaging resolution of microscopy-based debug techniques with on-chip microelectrodes

K.J.P. Jacobs / IMEC

(15) *15:35* Nanoprobing workflow on 5nm FinFET device

H. Wada, H.Y. Choi, C.H. Kang, and L. Tyler / Field Application Gr. Analytical Instruments/Materials and Structural Analisys, ThermoFisher SCIENTIFIC

· · · · · · · · · · 16:00～16:20 Authors corner & break · · · · · · · · · ·

### Invited Talk IV — p.m., Wed 8

*Chairman* Koji Nakamae

(I4) *16:20* The and future prospects and expectations for B5G and 6G

T. Watanabe / Grad. Sch. Information Science and Technology, Osaka Univ.

· · · · · · · · · · · · · · · 17:20～17:25 “Group Photo” · · · · · · · · · · · · · · ·

· · · · · · · · · · 17:25～17:45 Authors corner & break · · · · · · · · · ·

## Evening Session — p.m., Wed 8

*Chairman* Koji Nakamae

*18:00 – 20:00* Evening session of NANOTS is a special session for discussing on research trend around the world and the future perspective.

Location:

Senri Hankyu Hotel Osaka

Program:

- NANOTS2022 Awards
- Challenges for Failure Analysis listed by EDFAS (Hirotoshi Terada, Hamamatsu Photonics)

· · · · · · · · · · 20:00 Close · · · · · · · · · ·

# Thursday, Nov. 9, a.m. / Life Hall

## Metrology and Inspection I — a.m., Thu 9

*Chairman* Yuichiro Yamazaki

(16) *9:30* **Development of advanced area inspection SEM GS1000**

A. Ikegami, H. Dohi, Y. Kawamoto, and T. Kondou / Hitachi High-Tech Corp.

(17) *9:55* **A study on reproducibility improvement of deep learning for defect inspection method using scanning electron microscope**

T. Maeda[a], M. Harada[a], H. Kawano[b], and T. Hirai[b] / [a] AI-based Control Systems Research Dept., Connective Automation Innovation Center, Hitachi, Ltd., [b] Metrology Systems Product Div., Nano-Technology Solution Business Group, Hitachi High-Tech Corp.

(18) *10:20* **A study on the effect of unknown classes in domain adaptation for image classification**

D. Nishihara[a], Y. Midoh[a], Y. Ng[b], O. Yamane[b], M. Takahashi[b], G. Itoh[b], J. Shiomi[a], and N. Miura[a] / [a] Grad. Sch. Information Science and Technology, Osaka Univ., [b] Institute of Memory Technology Research & Development, Kioxia Corp.

· · · · · · · · · · 10:45～11:05 Authors corner & break · · · · · · · · · ·

## Metrology and Inspection II a.m., Thu 9

*Chairman* Suigen Kyoh

(19) *11:05* Direct observation of 3D flash memory structure by ultra-high resolution X-ray microscope
K. Omote and R. Hirose / X-Ray Research Lab., Rigaku Corp.

(20) *11:30* Development of advanced pattern contour extraction function for underness pattern in BSE see-through image of high voltage SEM
M. Oya[a], Y. Okamoto[b], S. Nakazawa[b], K. Maruyama[b], Y. Yamazaki[b], Y. Midoh[a], and N. Miura[a] / [a]Grad. Sch. Information Science and Technology, Osaka Univ., [b]TASMIT, Inc.

(21) *11:55* A relational analysis between physical sample features and electron microscope images
S. Asano, Y. Midoh, J. Shiomi, and N. Miura / Grad. Sch. Information Science and Technology, Osaka Univ.

· · · · · · · · · · 12:20～12:40 Authors corner & break · · · · · · · · · ·

· · · · · · · · · · · · · · · 12:40～13:25 Lunch Break · · · · · · · · · · · · · · ·

# Thursday, Nov. 9, p.m. / Life Hall

## Tutorial I p.m., Thu 9

*Chairman* Toru Koyama

(T1) *13:25* Analysis and reliability evaluation methods specific to power devices
Y. Ikemoto, Y. Koshiba, N. Yakumaru, and S. Oya / Quality and Technology Div., Qualtec Co., Ltd.

· · · · · · · · · · 14:25～14:45 Authors corner & break · · · · · · · · · ·

## Tutorial II p.m., Thu 9

*Chairman* Kiyoshi Nikawa

(T2) *14:45* Development of atom probe tomography for evaluation of semiconductor device
N. Mayama / Physical Analysis Technology Center, Toshiba Nanoanalysis Corp.

· · · · · · · · · · 15:45～16:05 Authors corner & break · · · · · · · · · ·

## Physical Analysis p.m., Thu 9

*Chairman* Yasuo Cho

(22) *16:05* **High-sensitivity automatic elemental identification method of STEM-EDS data**
T. Ide, T. Takahashi, Y. Shimada, A. Sugiyama, H. Maeda, and Y. Kunimune / Analysis and Evaluation Technology Div., Renesas Electronics

(23) *16:30* **Analysis of quasi-crystal by HAADF**
M. Kaneko / Research Organization for Advanced Engineering, Shibaura Institute of Technology

· · · · · · · · · · 16:55〜17:15 Authors corner & break · · · · · · · · · ·

(24) *17:15* **Closing remarks**
K. Nakamae / Chairman, The Institute of NANO Testing

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• Numbers show presentation numbers in the technical program.

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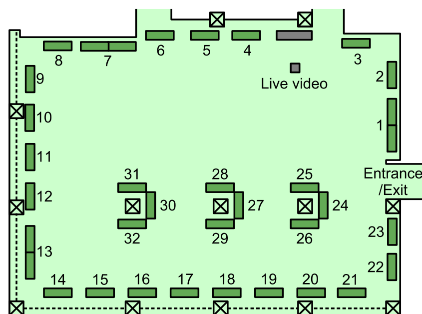
# 19 Exhibition

Date & time:

Tuesday, 7 November 2023, 13:00–17:00
Wednesday, 8 November 2023, 9:30–17:00
Thursday, 9 November 2023, 9:30–17:00

Venue: Senri room on 6rd floor




(The exhibition floorplan is subject to change without notice.)

1. Hamamatsu Photonics K.K.: (C6)
   Semiconductor failure analysis systems, Quantitative evaluation system for the quality of GaN single crystals

2. TOKI COMMERCIAL CO., LTD.: (C8)
   2D FTIR Spectroscopic Imaging System & Zooming Infrared Microscope
3. TOOL Corporation: (C4)
   Advanced Failure Analysis Technique using LAVIS-plus
4. ITES:ITES Co., Ltd.:
   Introduction of power semiconductor evaluation and analysis
5. Hanwa Trading Corporation:
   Signatone, Probe station and micro positioner
6. Plasma-Therm-Japan K.K.: (C16)
   Failure Analysis-Fast Deprocessing- Package Die, Die, Wafer
7. Ametek Co., Ltd. CAMECA BU:
   Secondary Ion Mass Spectormeter IMS 7f-Auto, NanoSIMS50L / Atom Probe Tomography LEAP6000XR
8. Nippon Barnes Company Ltd.:
   Lock-in Thermography “NBC LIT SCOPE II”
9. Nippon Scientific Co., Ltd.:
   Decap System and others
10. Hakuto Co., Ltd.:
    Infinity FA System / Ion Beam Delayering
11. APOLLOWAVE Corporation: (C9)
    NANO Robotics Solutions for Electron Microscopes
12. HiSOL, Inc.:
    Total Solution for Failure Analysis Process
13. Thermo Fisher Scientific: (C12)
    EFA systems, FIB, SEM, TEM systems and 3D analysis software for Device Analysis and Circuit Edit
14. Marubun corporation:
    Failure analysis solution
15. Semilab Japan KK:
    Product lineup for FA, and R&D ie Hall effect measurement PDL-1000
16. Park Systems Japan Inc.:
    Park AFM Failure Analysis
17. JEOL Ltd.: (C11)
    New FIB JIB-PS500i
18. Nikon Solutions Co., Ltd.:
    Multi Photon Photo Luminescence Microscope AXMP
19. Hightec Systems Corporation:
    JIACO MIP Decapsulation System & Neocera Magma MFI For Failure Analysis

20. IR System Co., Ltd.:
    Application of thermography for semiconductor failure analysis

21. SEIKO FUTURE CREATION INC.:
    Introducing IC wiring and circuit correction using FIB and foreign object detection technology using three-dimensional cross-sectional observation using FIB/TEM.

22. Renesas Engineering Services Co., Ltd.: (C10)
    Introduction of Photo Emission and OBIRCH analysis service by applying high voltage

23. Toshiba Nanoanalysis Corporation:
    Nano-level failure analysis by physical technique

24. Sanyu Co., Ltd.:
    Introduction of a new product - a local polishing machine for semiconductor devices

25. Hitachi High-Tech Corporation: (C2)(C13)
    Innovation, Synergy, Solutions -New EM Lineup

26. Excillum AB: (C7)
    Excillum' s microfocus X-ray tube technology for non-destructive submicron resolution

27. LTEC Corporation:
    Product benchmark analysis service

28. TOYO Corporation: (C14)
    TESCAN FIB-SEM system and real-time 4D-STEM

29. Qualtec Co., Ltd.: (C1)
    Solder void and crack nondestructive inspection using deep learning

30. Carl Zeiss Co., Ltd.: (C15)
    ZEISS Sample-in-Volume Analysis Workflow

31. ASTRON, Inc: (C5)
    CAD-Navigation system AZSA-HS

32. Oki Engineering Co., Ltd.: (C3)
    Applicability of LSI Process Diagnosis technique for fine process devices

# 20 List of Associate Members

(in alphabetic order, 6 September 2023)

- Aamilia Japan G.K.
- ADVANTEST CORPORATION
- AMETEK Co. Ltd.
- APOLLOWAVE Corp.
- Applied Materials, Inc.
- ASTRON Inc.

- ATE Service Corp.
- Carl Zeiss Co.,Ltd.
- Excillum AB
- FEI Company Japan Ltd.
- Hakuto Co., Ltd.
- Hamamatsu Photonics K.K.
- Hanwa Trading Corp.
- HiSOL, INC.
- Hitachi High-Tech Corporation
- Hightec Systems Corp.
- IR System Co., Ltd.
- ITES CO., Ltd.
- JEOL Ltd.
- KOBELCO RESEARCH INSTITUTE, INC.
- LTEC Co.
- MARUBUN CORPORATION
- Nano Tech Solutions Inc.
- NIKON SOLUTIONS CO., LTD.
- Nippon BARNES Company, Ltd.
- Nippon Scientific Co., Ltd
- Oki Engineering Co., Ltd.
- Park Systems Japan Inc.
- Plasma-Therm-Japan K.K.
- Qualtec Co., Ltd.
- Renesas Engineering Services, Co., Ltd.
- Sanyu Co.,Ltd.
- SEIKO FUTURE CREATION INC.
- Semilab Japan
- TASMIT, Inc.
- Toki Commercial Co., Ltd.
- TOOL CORPORATION
- Toshiba Nanoanalysis Corporation
- TOYO Corporation

(Rev.: 10-26–2023)