

2013 IEEE CPMT Symposium Japan (Formerly VLSI Packaging Workshop of Japan)

**Kyoto, Japan
11 – 13 November 2013**



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Symposium Program

November 11th, 2013

Room A (Centennial Hall): *Chairperson: Shigeru Nakagawa*

10:00 – 10:15 Opening Remarks & Welcome Talk:

Shigenori Aoki (General Chair, IEEE CPMT Symposium Japan; Fujitsu Laboratories Ltd.)

10:15 – 11:15 Plenary Speech 1

The end of transceivers as we know

Mehdi Asghari (Kotura, Inc.)

11:15 – 12:15 Plenary Speech 2

Toshiba packaging technology innovations create the new semiconductor products

Shuzo Akejima (Toshiba Corporation)

Room A (Centennial Hall)

13:15 – 15:15 Session 1: Advanced Packaging I

Chairperson: Kenji Takahashi, Shinya Takyu

1-1 **Invited : Design, Simulation, and Process Development of 2.5D TSV Interposer for High Density Packaging ""3**

Dongkai Shangguan^{1,2}, Xiaoli Ren¹, Kai Xue¹, Feng Jiang¹, Qibing, Wang^{1,2}, Ye Ping^{1,2}, Cheng Pang^{1,2}, Haiyan Liu¹, Cheng Xu², and Daquan Yu^{1,2} / National Center for Advanced Packaging, Institute of Microelectronics¹, Chinese Academy of Sciences²

1-2 **Invited : Bridging Between 3D Stacking and 3D IC Technologies ""P IC**

Wael Zohni, and Hiroaki Sato / Invensas Corporation

1-3 **A 77 GHz CMOS Power Amplifier Module Using Multi-layered redistribution Layer Technology ""7**

Masaru Sato, Yoshikatsu Ishizuki, Shinya Sasaki, Yoichi Kawano, Hiroshi Matsumura, Toshihide Suzuki, and Motoaki Tani / Fujitsu Laboratories Ltd.

1-4 **Warpage behavior of 2.5D Si-package using Si-interposer ""4**

Koji Hara, Kei Murayama, Mitsuhiro Aizawa, and Mitsutoshi Higashi / Shinko Electric Industries Co., LTD.

15:30 – 17:30 Session 2: Advanced Packaging II

Chairperson: Hiroshi Yamada, Yoichiro Kurita

2-1 **Invited : Perspective for Advanced Micro-solder Bump Bonding ""P IC**

Yasumitsu Orii / IBM Research - Tokyo

2-2 **Invited : POP package for Mobile Application Processor ""P IC**

Zhang Tonglong / Nantong Fujitsu Microelectronics Co.,Ltd

2-3 **Fine pitch PoP Introduction ""35**

Jinseong Kim¹, Gyuwan Han¹, Byoungwoo Cho¹, Yesul Ahn¹, Dongjoo Park¹, Juhoon Yoon¹, Glenn Rinne¹, Choonheung Lee¹, and Akito Yoshida² / Research and Development Center, Amkor Technology Korea Inc. ¹, Amkor Technology Japan ²

2-4 **Airfoil: A New Fine Line Fabrication Technology on Glass-cloth Prepreg without Insulating Films for PKG Substrate ""39**

Kumpei Yamada, Daisuke Fujimoto, Tetsuro Iwakura, Hikari Murai, Youichi Kaneko, and Hiroshi Shimizu / Hitachi Chemical Co., Ltd.

Room B (Conference Hall II)

13:15 – 15:15 Session 6: Optical Transceiver Module

Chairperson: Shigeru Nakagawa, Greg Fish

6-1 **Invited : High-speed optical engines and optical interconnect challenges and solutions ""P IC**

Mitch Fields / Avago Technologies

6-2 **A 25-Gb/s x 4ch, 8 x 8 mm² small size optical transceiver module for optical interconnection ""44**

Naoki Matsushima¹, Norio Chujo¹, Toshiaki Takai¹, Toru Yazaki¹, Daichi Kawamura², Yasunobu Matsuoka², Yong Lee², Hiroki Yamashita², Takashi Takemoto², Hideo Arimoto², Yoshiaki Ishigami³, Kinya Yamazaki³, and Yoshinori Sunaga³ / Yokohama Research Laboratory, Hitachi, Ltd. ¹, Central Research Laboratory, Hitachi, Ltd. ², Cable Materials Research Laboratory, Hitachi Metals, Ltd. ³

6-3 **Polymer waveguide-coupled 14-Gb/s x 12-channel parallel-optical modules mounted on optical PCB through Sn-Ag-Cu solder reflow ""48**

Aygl Fajar Rizky, Naoya Nishimura, Yoshinobu Nekado, Toshinori Uemura, and Hideyuki Nasu / Furukawa Electric Co., Ltd.

15:30 – 17:30 Session 7: Si Photonics and Single-Mode Optics

Chairperson: Bert Offrein, Mehdi Ashgari

- 7-1 **Invited : Heterogeneous Integration for Silicon Photonics ""P IC**
Greg Fish / Aurion
- 7-2 **Invited : Hybrid integration technology of laser source with laser diode arrays on silicon optical waveguide platform by flip-chip bonding for silicon photonics ""52**
Takanori Shimizu^{1,2}, Nobuaki Hatori^{1,2}, Makoto Okano^{1,3}, Masashige Ishizaka^{1,2}, Yutaka Urino^{1,2}, Tsuyoshi Yamamoto^{1,2}, Masahiko Mori^{1,3}, Takahiro Nakamura^{1,2}, and Yasuhiko Arakawa^{1,4} / Institute for Photonics-Electronics Convergence System Technology¹, Photonics Electronics Technology Research Association², National Institute of Advanced Industrial Science and Technology³, Insititute of Industrial Science, The University of Tokyo⁴
- 7-3 **Thermal Via Technology for Silica-based Planar Lightwave Circuit ""56**
Shinichi Aozasa, Yu Kurata, Yasuaki Hashizume, Mikitaka Itoh, and Hiroyuki Fukuyam / NTT Photonics Laboratories, NTT Corporation
- 7-4 **Direct coupling of cavity-resonator-integrated guided-mode resonance filter to a single-mode optical fiber""5: ""**
Junichi Inoue¹, Koji Hatanaka¹, Yuki Iwata¹, Kenji Kintaka², Kenzo Nishio¹, Yasuhiro Awatsuji¹, and Shogo Ura¹ / Kyoto Institute of Technology¹, National Institute of Advanced Industrial Science and Technology²

Room C (Conference Hall III)

13:15 – 15:15 Session 13: Power Integrity / Signal Integrity - Noise Suppression

Chairperson: Hideki Osaka, Takashi Harada

- 13-1 **Invited : Noise Suppression by Lossy Filters in Power Distribution Network ""P IC**
Yoshitaka Toyota and Kengo Iokibe / Okayama University
- 13-2 **Ultra-wideband Noise Suppression of Power Supply Noise by Combining Mushroom and Planar Type EBG Structures ""64**
Keisuke Ikemiya, Mayumi Sakai, and Toshio Sudo / Shibaura Institute of Technology
- 13-3 **Power integrity behavior for various packaging environments ""68**
Masahiro Terasaki, Sho Kiyoshige, Wataru Ichimura, Ryota Kobayashi, Genki Kubo, Hiroki Otsuka, and Toshio Sudo / Shibaura Institute of Technology

15:30 – 17:30 Session 14: Power Integrity / Signal Integrity - Modeling and Jitter

Chairperson: Yoshitaka Toyota, Daisuke Iguchi

- 14-1 **Invited : 2.5D Silicon Interposer PDN model for Power Aware SI analysis ""P IC**
Yukio Masuko / Cadence Design Systems, Inc.
- 14-2 **Power/Ground Wiring for High Speed Driver ""72**
Kaoru Hashimoto, Yutaka Akiyama, Chihiro Ueda, and Kanji Otsuka / Collaborative Research Center, Meisei University
- 14-3 **Power distribution network design method based on frequency-dependent target impedance for jitter design of memory interface""76**
Yasuhiro Ikeda, Masahiro Toyama, Satoshi Muraoka, Yutaka Uematsu, and Hideki Osaka / Yokohama Research Laboratory, Hitachi Ltd.
- 14-4 **A study on self turn-on phenomenon in fast switching operation of high voltage power MOSFET ""7:**
Tsuyoshi Funaki / Osaka University

November 12th, 2013

Room A (Centennial Hall): Chairperson: Takashi Harada

9:30 – 10:30 Plenary Speech 3

Mobile Device Challenges Leading Packaging Innovation

Steve Bezuk (Qualcomm)

Room A (Centennial Hall)

10:30 – 12:30 Session 3: 3D Technology I

Chairperson: Ping Cheng, Shoji Uegaki

- 3-1 **Invited : Cu Pillar – the Next Phase in the Evolution of the Packaging DNA""P IC ""**
William T. Chen / ASE Group
- 3-2 **Study of mechanical properties of Cu specimen using through-silicon-vias (TSV) electrodeposition bath ""84**
Huiying Wang¹, Ping Cheng¹, Su Wang², Hong Wang¹, Yang Yuan¹, Ting Gu¹ and Guiju Ding¹ / Shanghai Jiao Tong¹, Shanghai Sinyang Semiconductor Materials Co., Ltd.²

- 3-3 **Cu balls and Cu-core balls for 3D packaging ""87**
Hiroyoshi Kawasaki, Takahiro Hattori, Takahiro Roppongi, Daisuke Soma, Isamu Sato, and Yuji Kawamata / Senju Metal Industry Co., Ltd.
- 3-4 **Effect of leveler on microstructure and stress of electroplated copper for TSV application ""8:**
Xue Feng¹, Wei Luo¹, Ming Li¹, and Su Wang² / Shanghai Jiao Tong University¹, Shanghai Sinyang Semiconductor Materials Co. Ltd.²

13:30 – 15:30 Session 4: 3D Technology II

Chairperson: Ying-Hui Wang, Steve Bezuk

- 4-1 **Invited : Recent progress in through silicon vias (TSVs): Cu filling, microstructure characterization and mechanical properties ""P IC**
Ping Cheng¹, Hong Wang¹, Guifu Ding¹, Huiyin Wang¹, Zhaoyu Wang¹, Ming Li¹, and Jiangyan Sun² / Shanghai Jiao Tong University¹, Shanghai Sinyang Semiconductor Materials Co., Ltd.²
- 4-2 **Development of a Chip Prober for Pre-Bond Testing of a 3D-IC ""94**
Naoya Watanabe¹, Motohiro Suzuki¹, Michiyuki Eto², Kenji Kawano², and Masahiro Aoyagi¹ / Nanoelectronics Research Institute, National Institute of Advanced Industrial Science and Technology¹, STK TECHNOLOGY CO., LTD.²
- 4-3 **A numerical model for Bottom-up copper electrodeposition of TSV with additives ""98**
Wei LUO, Xue FENG, and Ming LI / Shanghai Jiao Tong University
- 4-4 **Growth models of copper filling in through silicon via at different current density ""2 ""**
Zhaoyu Wang¹, Ping Cheng¹, Hong Wang¹, Honglei Guo¹, Guifu Ding¹, Xiaolin Zhao¹, and Jianhua Li² / Shanghai Jiao Tong University¹, Huaihai Industries Group Co.Ltd.²

15:45 – 17:45 Session 5: High-speed Interconnect

Chairperson: Yutaka Uematsu, Keitaro Yamagishi

- 5-1 **Invited : High-speed transmission copper cable for 25Gbit/s/lane ""6**
Takahiro Sugiyama¹, Hideki Nonen¹, Izumi Fukasaku¹, Takashi Kumakura², and Hiroshi Ishikawa¹ / Cable Materials Laboratory, Cable Materials Company, Hitachi Metals, Ltd.¹, Electric Wire & Cable Division, Cable Materials Company, Hitachi Metals, Ltd.²
- 5-2 **The effect of surface roughness on high frequency transmission line "" :**
Toshiki Iwai, Daisuke Mizutani, and Motoaki Tani / Fujitsu Laboratories Ltd.
- 5-3 **A Cost Effective TO-CAN Packaged 10 Gbps EML Module Employing Inductance Compensation Technique ""4**
Mizuki Shirao, Nobuo Ohata, Kenichi Uto, and Hiroshi Aruga / Information Technology R&D Center, Mitsubishi Electric Corporation
- 5-4 **High Bandwidth Application with Wide I/O Memory on 2.5DIC Silicon Interposer ""8**
Chen-Chao Wang, Hung-Hsiang Cheng, Ming-Feng Chung, Po-Chih Pan, Chi-Tsung Chiu, and Chih-Pin Hung / Electrical Laboratory, Advanced Semiconductor Engineering Inc.

Room B (Conference Hall II)

10:30 – 12:30 Session 8: Optics for Computing I

Chairperson: Mitch Fields, Shogo Ura

- 8-1 **Invited : Photonics for computing applications ""P IC**
Bert Offrein / IBM Research - Zurich
- 8-2 **Demonstration of high-bandwidth density and low-power organic optical MCM link ""322**
Masao Tokunari, Seiji Takeda, Hsiang-Han Hsu, and Shigeru Nakagawa / IBM Research - Tokyo
- 8-3 **No-Polish Elastic Optical Multifiber Connector for Optical Interconnection ""326**
Tsuyoshi Aoki¹, Hidenobu Muranaka¹, Shigenori Aoki¹, Katsuki Suematsu², Mitsuhiko Iwaya², and Masato Shiino² / Fujitsu Laboratories Ltd.¹, Furukawa Electric Co., Ltd.²
- 8-4 **Optical Multi-channel Connector for Rigid Waveguide and Fiber Connection ""32:**
Kazumi Nakazuru¹, Masatoshi Tsunoda¹, Naoki Takahashi¹, Satoshi Asai², and Takahiro Matsubara² / KYOCERA Connector Products Corporation¹, KYOCERA Corporation²

13:30 – 15:30 Session 9: Optics for Computing II

Chairperson: Shigenori Aoki, Yuzo Sasaki

- 9-1 **Invited : Waveguide gratings for in-line wavelength-selective modulators in high-density optical interconnects ""P IC**
Shougo Ura¹ and Kenji Kintaka² / Kyoto Institute of Technology¹, National Institute of Advanced Industrial Science and Technology²
- 9-2 **Self-Written Waveguide Technology with Light-curable Resin Enabling Easy Optical Interconnection ""334**
Yukinobu Soeda, Tadayuki Enomoto, and Osamu Mikami / School of Engineering, Tokai University
- 9-3 **Highly efficient connectivity between VCSEL and multimode optical waveguide ""338**
Hiroki Ishikawa¹, Ryota Kinoshita¹, and Takaaki Ishigure² / Graduate School of Science and Technology, Keio University¹, Faculty of Science and Technology, Keio University²
- 9-4 **Organic-inorganic hybrid material for on-board optical interconnection and it's applications in optical coupling ""33;**
Hideyuki Nawata / Nissan Chemical Industries, LTD.

15:45 – 17:45 Session 10: Optical Communication and Lighting Technology

Chairperson: Osamu Mikami, Takaaki Ishigure

- 10-1 **Invited : High-speed KTN optical beam deflector for swept-source optical coherence tomography ""345**
Yuzo Sasaki¹, Yuichi Okabe¹, Masahiro Ueno¹, Takashi Sakamoto¹, Seiji Toyoda¹, Junya Kobayashi¹, Shogo Yagi², and Kazunori Naganuma² / NTT Photonics Laboratories, NTT Corporation¹, NTT Advanced Technology Corporation²
- 10-2 **Modal power distributions in short reach optical communication using step-index-type multimode optical fibers ""349**
Manabu Kagami, Akari Kawasaki, and Masatoshi Yonemura / Toyota Central R&D Labs., Inc.
- 10-3 **Serially-Grafted Electrooptic Polymer Waveguide Fabricated by Thermal Imprint Lithography ""353**
Okihiko Sugihara, Toshiaki Hirata, Freddy Susanto Tan, and Toshikuni Kaino / Institute of Multidisciplinary Research for Advanced Materials, Tohoku University
- 10-4 **A damage-free sapphire substrate removal process to realize highly manufacturable wafer-level white LED package ""355**
Miyuki Shimojuku, Akihiro Kojima, Miyoko Shimada, Hideyuki Tomizawa, Yosuke Akimoto, Hideto Furuyama, Yoshiaki Sugizaki, and Hideki Shibata / Center for Semiconductor Research & Development, Toshiba Corporation Semiconductor & Storage Products Company

Room C (Conference Hall III)

10:30 – 12:30 Session 15: Micro Bump Bonding

Chairperson: Kiyokazu Yasuda, Takashi Hisada

- 15-1 **Invited : Bump & Ball Interconnect Technology Update ""P IC**
Akito Yoshida / Amkor Technology Japan
- 15-2 **Novel Bonding Method Using Cu Bumps Coated With Flexible Ag Nanoparticle Layer Formed By Squeegee-Coating ""357**
Weixin Fu, Jun Mizuno, Shuichi Shoji, Takashi Kasahara, Akiko Okada, and Shugo Ishizuka / Waseda University
- 15-3 **Influence of Diffusion on Solid-state Bonding for Micro-bumps at Low Temperatures ""35;**
Ying-Hui Wang¹ and Tadatomo Suga² / The Institute of Innovation in International Engineering Education, School of Engineering, The University of Tokyo¹, Department of Precision Engineering, School of Engineering, The University of Tokyo²
- 15-4 **Mechanical Properties of Sn-58Bi, In-3Ag and SAC305 Solders Measured with Fine Diameter Specimens ""365**
Takashi Hisada¹, Ikuo Shohji², Yasuharu Yamada¹, Kazushige Toriyama¹, and Mamoru Ueno¹ / IBM Tokyo Laboratory, IBM Japan, Ltd.¹, Faculty of Science and Technology, Gunma University²

13:30 – 15:30 Session 16: Novel Hybrid Bonding

Chairperson: Jun Mizuno, Nobuhiro Imaizumi

- 16-1 **VUV-Assisted Low Temperature Bonding For Organic/Inorganic Hybrid Integration at Atmospheric Pressure ""369**
Akitsu Shigetou¹, Mano Ajayan², and Jun Mizuno³ / National Institute for Materials Science¹, School of Advanced Science and Engineering Waseda University², Institute for Nanoscience and Nanotechnology Waseda University³
- 16-2 **Direct Bonding of PEN at Room Temperature by Means of Surface Activated Bonding method using Nano-adhesion Layer ""373**
Takeshi Matsumae, Masahisa Fujino, and Tadatomo Suga / The Department of Precision Engineering, The School of Engineering, The University of Tokyo
- 16-3 **Thermal reliability of Ag-8Au-3Pd alloy wire bonds ""376**
Rui Guo¹, Cheng Yin¹, Dali Mao¹, Ming Li¹, Zhong Lv², and Hope Chiu² / Shanghai Jiao Tong University¹, SanDisk Semiconductor (Shanghai) Co., Ltd.²
- 16-4 **Microstructural Control of Electrically Conductive Adhesives with Ag micro-fillers by Binder Chemistry ""37:**
Masahiro Inoue¹, Yasunori Tada¹, Hiroaki Muta², and Shinsuke Yamanaka² / Gunma University¹, Osaka University²

15:45 – 17:45 Session 17: Materials for Packaging

Chairperson: Masahiro Inoue, Akitsu Shigetou

- 17-1 **Metal-filled anodized aluminum oxide
A potential substrate material for a high density interconnection in 3D packaging ""P IC**
Yoshinori Hotta and Kousuke Yamashita / Fujifilm Corporation
- 17-2 **Improvement of chemical resistance of positive-tone photosensitive polyimide coatings in the electroless plating process ""384**
Osamu Baba, Satoshi Kanemoto, Yuki Masuda, Tomoyuki Yuba, and Masao Tomikawa / Electronic & Imaging Materials Research Laboratory, Toray Industries, Inc. Shiga Plant
- 17-3 **Preparation of Solder Plated Patterns on Paper and Applying to RFID Tags ""388**
Yuichi Sakai¹, Katsuhiko Sasaki¹, Tomoaki Futakuchi¹, Ken-ichi Honda², Keiichi Hirose², and Akihiro Inoda² / Toyama Industrial Technology Center¹, Tateyama Kagaku Industry Co., Ltd²
- 17-4 **New ultra low CTE material to reduce the warpage of thinner PKG ""392**
Tomohiko Kotake, Hikari Murai, Shin Takanezawa, Masato Miyatake, Masaaki Takekoshi, and Masahisa Ose / Hitachi Chemical Co.,Ltd.

November 13th, 2013

Room A (Centennial Hall): Chairperson: Daisuke Iguchi

9:30 – 10:00 Special Talk 1 by CPMT President

The Role of IEEE-CPMT in the Evolution of Microelectronics Packaging Technologies

S.W. Ricky Lee (Hong Kong University of Science and Technology)

10:00 – 10:30 Special Talk 2 by Chairman of IEEE-CPMT China Chapter

Activities and Prospect of IEEE-CPMT China Chapter

Jusheng Ma (Tsinghua University)

Room B (Conference Hall II)

10:45 – 12:20 Session 11: Component and Circuits

Chairperson: Hideyuki Ohashi, Yutaka Uematsu

11-1 **A Broadband Antenna with Fan-Shaped and Trapezoidal Elements on Printed Circuit Board for Ultra-Wideband Radio** ""396

Fukuro Koshiji¹, Kazuya Hiraguri¹, and Kohji Koshiji² / Kokushikan University¹, Tokyo University of Science²

11-2 **Electromagnetic Field Analysis of a Broadband Antenna Built for Third-Generation Mobile and UWB Communications Considering the Effects of Dielectric Housing** ""39:

Yusuke Akiyama¹, Fukuro Koshiji¹, and Kohji Koshiji² / Kokushikan University¹, Tokyo University of Science²

11-3 **Development of Touch Panel System by Single Layer without Pattern** ""3: 4

Yoichi Sato¹, Yutaka Akiyama¹, Kaoru Hashimoto¹, Koichi Meguro², and Kanji Otsuka¹ / Collaborative Research Center, Meisei University¹, Jitech Co., Ltd.²

13:20 – 15:20 Session 12: Cooling/Thermal

Chairperson: Kishio Yokouchi, Tomoyuki Hatakeyama

12-1 **Applied Voltage Dependence of Hotspot Location and Temperature in Power Si MOSFET** ""3: 8

Risako Kibushi, Tomoyuki Hatakeyama, Shinji Nakagawa, and Masaru Ishizuka / Toyama Prefectural University

12-2 **Optimal Laser Condition for Laser Soldering in Cream and Ring Solder** ""3: 2

Risako Kibushi, Tomoyuki Hatakeyama, Dai Imai, Shinji Nakagawa, and Masaru Ishizuka / Toyama Prefectural University

12-3 **Effects of Obstruction in front of a Piezoelectric Micro Blower on Performance Characteristics** ""3: 6

Takashi Fukue¹, Koichi Hirose¹, Yoshiki Matsuura¹, and Hirotoshi Terao² / Iwate University¹, ALPS Electronic Co., Ltd.²

12-4 **Low Profile Cooling Solutions for Advanced Packaging Based on Ultra-Thin Heat Pipe and Piezo Fan** ""3: :

Randeep Singh, Masataka Mochizuki, Mohammed Ahamed Shahed, Yuji Saito, Ahmed Jalilvand, Masahiro Matsuda, Yoji Kawahara, and Kazuhiko Goto / R&D Department, Thermal Technology Division, Fujikura Ltd.

Room C (Conference Hall III)

10:45 – 12:20 Session 18: Reliability I

Chairperson: Kenji Hirohata, Masaki Hashizume

18-1 **A Finite Element Analysis of Board Level Drop Reliability Test and Analysis of Stress Buffer Effect of Polyimide** ""424

Mitsuru Fujita¹, Nobuhiro Anzai¹, Kazutoshi Sakamaki², and Yoshiharu Kariya³ / Asahi Kasei E-materials Corporation¹, Graduate school of Shibaura institute of technology², Materials science and Engineering department, Shibaura institute of technology³

18-2 **Built-in IDDT Appearance Time Sensor for Detecting Open Faults in 3D IC** ""428

Shohei Suenaga¹, Masaki Hashizume¹, Hiroyuki Yotsuyanagi¹, Tetsuo Tada², and Shyue-Kung Lu³ / The Univ. of Tokushima¹, Tokushima Bunri University², National Taiwan University of Science and Technology³

18-3 **Reduction Method of Number of Electromagnetic Simulation Times for Estimating Output Voltage at Hard Open TSV in 3D IC** ""432

Ei Haraguchi¹, Masaki Hashizume¹, Katsuya Manabe¹, Hiroyuki Yotsuyanagi¹, Tetsuo Tada², Shyue-Kung Lu³, and Zvi Roth⁴ / The Univ. of Tokushima¹, Tokushima Bunri University², National Taiwan University of Science and Technology³, Florida Atlantic University⁴

13:20 – 15:20 Session 19: Reliability II

Chairperson: Masaki Hashizume, Kenji Hirohata

- 19-1 **Failure analysis of electric circuit board by high resolution magnetic field microscopy ""436**
Yuki Mima¹, Noriaki Oyabu², Takeshi Inao³, Noriaki Kimura⁴, and Kenjiro Kimura¹ / Kobe University¹, Kyoto University², Murata Manufacturing Company, Ltd.³, Integral Geometry Instruments⁴
- 19-2 **Nondestructive Observation of Fatigue Crack Propagation Process in Some Solder Joints by Synchrotron Radiation X-ray Micro-tomography""43:**
Hiroyuki Tsuritani¹, Toshihiko Sayama¹, Yoshiyuki Okamoto², Takeshi Takayanagi², Kentaro Uesugi³, and Takao Mori⁴ / Toyama Industrial Technology Center¹, Cosel Co., Ltd.², Japan Synchrotron Radiation Research Institute³, Toyama Prefectural University⁴
- 19-3 **Nondestructive defect analysis case example using combination of Lock-in IR Thermography and high resolution X-ray CT technology""P IC ""**
Naoki Seimiya¹ and Takuhei Watanabe² / Marubun Corporation¹, Uni-Hite System Corporation²
- 19-4 **Development of High-speed X-ray CT Inspection System Using X-ray Line Sensor ""444**
Daisuke Suzuki¹, Kenji Noguchi¹, Takayuki Murakoshi¹, and Atsushi Teramoto² / Nagoya electric works Co., Ltd.¹, Fujita Health University²