3rd Electronics System Integration Technology Conference

(ESTC 2010)

Berlin, Germany
13-16 September 2010

Pages 1-566

IEEE Catalog Number: CFP10TEM-PRT
ISBN: 978-1-4244-8553-6

TABLE OF CONTENTS

ADVANCED PACKAGING (AP-1) – 3D INTEGRATION AND RF-PACKAGING

3D IC Infrastructure Status and Issues 1
E. J. Vardaman

Hermetic Wafer-Level Packaging Technology Development for RF MEMS Switch 7
C. Ferrandon, F. Greco, E. Lagoutte, P. Descours, G. Enyedy, M. Pellat, C. Gillot, P. Rey, D. Mercier, M. Cueff, X. Baillin, F. Perruchot, N. Sillon, L. J. Liu, S. Pacheco, M. Miller

Integration of a 3D Microwave Module 13
X. Sun, P. Soussan, A. La Manna, B. Majeed, W. De Raedt, P. Monfraix

TSV as an Alternative to Wire Bonding for a Wireless Industrial Product: Another Step towards 3D Integration 17
G. Druais, P. Ancey, L. L. Chapelon, J. Charbonnier, S. Cheramy, Y. Dodo, A. Farcy, G. Garnier, Y. Guillou, D. Henry, P. Leduc, J. Pruvost, E. Saugier, N. Sillon

ADVANCED PACKAGING (AP-2) – WAFER LEVEL

Thin Wafer Processing and Chip Stacking for 3D Integration 21
T. Matthias, B. Kim, M. Wimplinger, P. Lindner

Eutectic Wafer Bonding for 3D Integration 27
M. Baum, M. Wiemer, A. Schneider, H. Rank, A. Trautmann, T. Gessner, C. Jia, M. Haubold

Wafer-to-Wafer Hybrid Bonding Technology for 3D IC 33
Cheng-Ta Ko, Zhi-Cheng Hsiao, Huan-Chun Fu, Kuan-Neng Chen, Wei-Chung Lo, Yu-Hua Chen

Technology Trends in the Manufacturing and Packaging of Wafer Level Cameras 38
R. Zoberbier, A. Kraft, R. Voelkel, D. Toennies, M. Hennemeyer, M. Eisner

ADVANCED PACKAGING (AP-3) – 2ND LEVEL INTERCONNECT

3D Substrate Innovation for Complex High Pin Count Flip-Chip Applications 43
V. Solberg, V. Oganesian

Reliability Improvements for Large Scale Wafer Level Packaging 47
J. Hunt, D. Huang, J. Chiu, Maggie M. C. Liu, J. Lin, J. W. Lo, C. Chen, C.-L. Kao

Reliability Testing of Cu-Sn Intermetallic Micro-Bump Interconnections for 3D-Device Stacking 53
R. Labie, P. Limaye, K. Wook Lee, C. J. Berry, E. Beyne, I. De Wolf

Process Integration of Fine Pitch Micro-Bumping and Cu Redistribution Wiring for Power Efficient SiP 58
H. Ezawa, T. Migita, S. Yamashita, Y. Koshio, M. Fukuda, T. Togasaki, M. Miyita, K. Nagamine, T. IIjima, M. Inohara

ADVANCED PACKAGING (AP-4) - TECHNOLOGIES

Stacked Anodized Metal Substrate for High Thermal Dissipation Performance 64
C. H. Lim, Y. K. Lee, K. H. Seo, J. W. Kim, S. M. Choi

Wire-Bonding on Inkjet-Printed Silver Pads Reinforced by Electroless Plating for Chip on Flexible Board Packages 68
R. Cauchois, M. Saadaoui, J. Legeleux, T. Malia, B. Dubois-Bonvalot, K. Inal, J.-C. Fidalgo

Low Profile CSP (LP-CSP) Technology for Ultra-Thin IC Packaging Applications 74
U. Sharma, P. Holland, H. Gee, L. Ning, R. Swamy

Module Miniaturization by Ultra Thin Package Stacking 78
T. Loeher, D. Schütze, W. Christiaens, K. Dhaenens, A. Ostmann, J. Vanfleteren, S. Priyabadini

ADVANCED PACKAGING (AP-5) - EMBEDDING

System Integration with eWLB 83
T. Meyer, G. Ofner, B. Römer, K. Pressel
Fan-Out Wafer-Level Packaging with Highly Flexible Design Capability 92
Y. Kurita, T. Kimura, K. Shibuya, H. Kobayashi, F. Kawashiro, N. Motohashi, M. Kawano
Implementation of Chip Embedding Processes for the Creation of Miniaturized System-in-Packages 98
L. Boettcher, D. Manessis, A. Ostmann, S. Karaszkiewicz, R. Aschenbrenner, K.-D. Lang

MODELING AND SIMULATION (MS-1) – POWER AND RF

Accurate 3D Electromagnetic Simulation of RF System-in-Package 104
N.-H. Huynh, K. Pressel, B. Roemer
Modular Modeling Approach to Consider RF and Thermal Behavior of Complex Systems Built up Using Interconnect Structures in 3D Integration 106
S. Reitz, J. Stolle, R. Martin, A. Wilde, P. Schneider
Simulation of Power Delivery Networks with Joule Heating Effects for 3D Integration 112
J. Xie, M. Swaminathan
Thermal Test Vehicle for the Validation of Thermal Modelling of Hot Spot Dissipation in 3D Stacked ICs 118
H. Oprins, V. Cherman, C. Torregiani, M. Stucchi, B. Vandevelde, E. Beyne

MODELING AND SIMULATION (MS-2) – RELIABILITY APPLICATIONS I

Virtual Qualification - The Step into a New Period of Automotive Electronic Development 124
A. Schießl, D. Wolf, A. Bernhardt, A. Schingale
Rapid Virtual Testing of Structural Integrity in Microelectronic Assemblies 128
M. H. Shirangi, C. Otto, A. Fischer, P. Van Staa, W. H. Müller, B. Michel
Adhesion of Moulding Compounds on Various Surfaces. A Study on Moisture Influence and Degradation after High Temperature Storage 136
R. Pufall, M. Goroll, M. Bouazza, O. Wittler, B. Michel
Highly Integrated Advanced Power Electronic Systems for Automotive Applications 139
J.-P. Sommer, T. Hofmann, A. Neumann, A. Podlasly, B. Michel

MODELING AND SIMULATION (MS-3) – RELIABILITY TESTING AND SIMULATION I

Modeling and Validation of Evaluation Method on IC Chip Pick-up Performance of Dicing/Die Bonding Tape 144
N. Saiki, K. Inaba, K. Kishimoto, H. Seno, I. Ichikawa
Underfill and Mold Compound Influence on PoP Ageing Under High Current and High Temperature Stress 150
L. Meinshausen, K. Weide-Zaage, H. Frémont
Reliability Study of the Stud Bump Bonding Flip Chip Technology on Molded Interconnect Devices 156
M. Dressler, B. Wunderle, K.-F. Becker, H. Reichl
Interface Fracture Mechanics Evaluation by Correlation of Experiment and Simulation 162
J. Keller, I. Maus, G. Schlottig, H. Pape, B. Wunderle, B. Michel

MODELING AND SIMULATION (MS-4) – RELIABILITY TESTING AND SIMULATION II

Mechanical Characterization of Gold and Copper Free Air Balls in Thermosonic Wire Bond Interconnections 167
G. Lorenz, C. Dresbach, M. Petzold, M. Mittag, E. Milke
A Microscope System for Characterization of Mechanical Properties of Small-Scaled Objects 173
H. Tohmyoh, M. A. S. Akanda, M. Saka
Application of Multi-Criteria Optimization Algorithms to Numerical Material Extraction of Thin Layers Through Nanoindentation Technique 177
L. Dowhan, A. Wymyslowski, P. Janus, M. Ekwinska, O. Wittler

Crack and Damage Evaluation in Low-k BEoL Stacks under Assembly and CPI Aspects 184
J. Auersperg, D. Vogel, M. U. Lehr, M. Grillberger, B. Michel

MODELING AND SIMULATION (MS-5) – RELIABILITY APPLICATIONS II

Mechanical Issues Induced by Electrical Wafer Sort: Correlations from Actual Tests, Nanoindentation and 3D Dynamic Modeling 188
R. Roucou, V. Fiori, K. Inal, H. Jaouen

Device Simulation for Evaluating Effects of Mechanical Stress on Semiconductor Devices: Impact of Stress-Induced Variation of Electron Effective Mass 194
M. Koganemaru, K. Yoshida, T. Ikeda, N. Miyazaki, H. Tomokage

Fracture Analysis of Interface Delamination in Metal-Insulator-Metal Capacitor Device 200
M.-C. Hsieh, S.-T. Wu, C.-H. Chen

Multi-Physics Modelling for Packaging of Liquid Crystal Displays in Harsh Environments 205
C. Bailey, H. Lu, C. Yin, Y. Lee

MDS Investigation on the Heat Transfer Properties of CNT Micro-Channel Cooler 211
Y. Zhang, S. Wang, J.-Y. Fan, J. Liu

On Model Fitting Methods for Analysis of Polymer Cure Kinetics in Microelectronics Assembly Applications 216
T. Tilford, J. E. Morris, M. Ferenets, P. R. Rajaguru, S. Pavuluri, M. Desmulliez, C. Bailey

Simulation of Electro-Thermal Interaction 222
A. Wilde, R. Jancke, R. Martin, S. Reitz, P. Schneider

APPLIED RELIABILITY (AR-1) – SOLDER INTERCONNECT

Failure Mechanism of Solder Interconnections under Thermal Cycling Conditions 228
T. Mattila, M. Mueller, M. Paulasto-Kröckel, K.-J. Wolter

Influence of Indium on Microstructure and Creep Properties of SnAg3.5InX (X=0,2,4,8) Solder Alloys 236
J. C. Boareto, R. Metasch, M. Roellig, P. A. P. Wendhausen, K.-J. Wolter

Solder Joint Reliability in Automotive Applications: Describing and Understanding Damage Mechanisms through the Use of EBSD 241
A. Steller, U. Pape, R. Dudek

Impact of Thermal Aging on the Thermal Fatigue Durability of Pb-Free Solder Joints 245
P. Chauhan, M. Mueller, M. Osterman, M. Pecht

APPLIED RELIABILITY (AR-2) – SOLDER MICROSTRUCTURES

The Scaling Effect on Microstructure and Creep Properties of Sn-Based Solders 255
S. Wiese, M. Mueller, I. Panchenko, R. Metasch, K.-J. Wolter, M. Roellig

On the Role of Electromigration in Power Cycling Tests 263
J. Karppinen, V. Vuorinen, T. Laurila, M. Paulasto-Kröckel, A. Paul

Employing Solder Joints of Concave Shape for Monitoring Electromigration Independently of Material Interfaces 270
J. Jaeschke, W. H. Müller, N. Nissen, H. Reichl

APPLIED RELIABILITY (AR-3) – MATERIAL AND RELIABILITY

Influence of Solder and Pad Coating Constitution on Fatigue of Lead-free Solder Joints under Combined Vibration and Temperature Cycling Loading 276
P. Matkowski, J. Felba

Investigation of Adhesive Bonding on Base Metal in Electronic Packaging 281
A. Paproth, B. Adolphi, K.-J. Wolter

fibDAC Stress Relief – A Novel Stress Measurement Approach with High Spatial Resolution 287
D. Vogel, I. Maus, B. Michel

Flexible Test Bench to Study the Reliability of Electronics Assemblies 292
K. Moreau, M. Grieu, C. Munier, S. Bousquet

APPLIED RELIABILITY (AR-4) – EXPERIMENT AND TESTING

Development of a Mechanical Stress-Analysing-Tool to Characterize Packaging Processes 297
S. Höll, S. Majcherek, S. Hirsch, B. Schmidt

Localization of Electrical Defects in System in Package Devices Using Lock-In Thermography 303
C. Schmidt, C. Große, F. Altmann

Experimental Damage Analysis and Numerical Reliability Modeling of Lead-Free Ball-Grid-Array Second Level Interconnects 308
D. Pustan, J. Wilde, W. Zhang

Effect Mechanism of Moisture Diffusion on LED Reliability 314
B. Wu, X. Luo, S. Liu

APPLIED RELIABILITY (AR-5) – MOISTURE/MICROSTRUCTURE

Electron Backscatter Diffraction Microstructure Investigations of Electronic Materials Down to the Nanoscale 319
M. Krause, B. März, C. Dresbach, M. Petzold

Understanding Die Attach Materials Performance in Electronic Packages under Harsh Environments 325
M. Sousa, S. Riches, C. Johnston, P. S. Grant

A Novel Vapor Pressure Transfusion Model for the Popcorning Analysis of Quad Flat No-Lead (QFN) Packages 331
M. Zhang, S.-W. R. Lee

Influence of Moisture on Humidity Sensitive Material Parameters of Polymers Used in Microelectronic Applications 340
H. Walter, B. Wunderle, E. Dermitzaki, B. Michel

APPLIED RELIABILITY (AR-6) – STRESS AND STRAIN

Formation of Mechanical Strains in the Component Board of a High-End Handheld Product during Shock Impact 345
J. Karppinen, J. Pakarinen, J. Li, T. Mattila, M. Paulasto-Kröckel

Electrical Stress on Film Resistive Structures on Flexible Substrates 352
D. Bonfert, G. Klink, H. Gieser, K. Bock, P. Svasta, C. Ionescu

Advanced Assessment of Thermal Stress Related Failure Modes Occurring During the Assembly of High Pin Count BGAs on PCBs 358
M. Hertl, D. Weidmann

Investigation into the Impact of Component Floor Plan Layout on the Overall Reliability of Electronics Systems in Harsh Environments 364
D. Braden, D. Harvey, G.-M. Zhang, R. Yang, J. Duralek

ELECTRICAL DESIGN & MODELING (ED-1)

Current Density Simulations for Polymer Cored CSP Interconnects 370
D. Whalley, H. Kristiansen

Passive Parametric Modeling of Interconnects and Packaging Components from Sampled Impedance, Admittance or Scattering Data 375
P. Triverio, S. Grivet-Talocia, M. Nakhla

Crosstalk Analysis in High Density Connector Via Pin Fields for Digital Backplane Applications Using a 12-Port Vector Network Analyzer 381
M. Kotzev, R. Frech, H. Harrer, D. Kaller, A. Huber, T.-M. Winkel, H.-D. Brüns, C. Schuster

Modeling and Analysis of Coplanar Bonding Wires for High-Speed Applications 387
I. Ndip, C. Tschoban, S. Schmidt, M. Schneider-Ramelow, S. Guttowski, K.-D. Lang, H. Reichl

ELECTRICAL DESIGN & MODELING (ED-2) – 3D RELATED MODELING

Power Integrity Analysis by Using a Coupled Field-Circuit Method 391
E.-P. Li, X.-C. Wei

TSV Modeling and Noise Coupling in 3D IC 395
J. Kim, J. Cho, J. Kim

Electrical Evaluation of Wafer Level Fan Out (WLFO) Package Using Organic Substrate for Microwave Applications 401
S. J. Lee, S. W. Kim, G. W. Kim, K. C. Bae, J. H. Yu, J. Y. Kim, H. Y. Yoo, C. H. Lee

ASSEMBLY AND MANUFACTURING TECHNOLOGY (AM-1) – ASSEMBLY TECHNOLOGIES

Flip Chip Bonding with Elasticity Bonding System and Non Conductive Film Suitable for Intermetallic Compounds Formation 407
R. Kojima, T. Matsumura, T. Saito, T. Koyama, N. Umetsu, J. Nishimura, K. Furuta, H. Moriyama

Au–Sn Fluxless SLID Bonding: Effect of Bonding Temperature for Stability at High Temperature, above 400ºC 411
K. Aasmundtveit, T. Thuy Luu, H. Vu Nguyen, R. Johannessen, N. Hoivik, K. Wang

Adapted Assembly Processes for Flip-Chip Technology with Solder Bumps of 50 µm or 40 µm Diameter 417
R. Dohle, F. Schüßler, J. Franke, T. Friedrich, J. Goßler, T. Oppert

Influence of the Processing Method on the Amount and Development of Voids in Miniaturized Interconnections 425
B. Dimcic, R. Labie, B. Verlinden, I. De Wolf, W. Zhang

ASSEMBLY AND MANUFACTURING TECHNOLOGY (AM-2) – THIN/FLEXIBLE SYSTEM

Packaging Challenges Associated with Warpage of Ultra-Thin Chips 430
Mahadi-Ul Hassan, A. Angelopoulos, H. Rempp, S. Endler, J. Burghartz

Ultra-Flexible and Ultra-Thin Embedded Medical Devices on Large Area Panels 435
G. Kunkel, T. Debski, H. Burkard, J. Link, A. E. Petersen, W. Christiaens, J. Vanfleteren

Thin Die / Novel Process for Stack Die Packages and Yield Optimization 438
T. Stöckli, I. Rodríguez, U. Ernst, O. Harnisch

SCB - Stamped Circuit Board Technology 443
M. Benedikt, T. Stenger, A. Klein, F. Krüger

ASSEMBLY AND MANUFACTURING TECHNOLOGY (AM-3) – RF-PACKAGING AND MANUFACTURING OPTIMIZATION

Investigation of RFID Tag Antennas Printed on Flexible Substrates Using Two Types of Conductive Pastes 444
K. Janeczek, G. Koziol, T. Serzysko, M. Jakubowska

Experimental Investigation of Open-Ended Microwave Oven Assisted Encapsulation Process 449
S. Pavuluri, M. Ferenets, G. Goussetis, M. Desmulliez, T. Tilford, R. Adamietz, F. Eicher, C. Bailey

High Yield Thermode Bond Process Under Activated Atmosphere and Automatic Thermal Interface Measurement for High Power Optoelectronic Devices 455
G. Elger, R. Lauterbach, R. Feder, K. Dankwart, C. Zilkens

Self-Assembly and Self-Interconnection of Thin RFID Devices on Plasma-Programmed Foil Substrates 460
E. Yacoub-George, W. Hell, C. Landesberger, K. Bock

ASSEMBLY AND MANUFACTURING TECHNOLOGY (AM-4) – WIRE BONDING

Aluminium Wedge-Wedge Wire Bonding on Thermoplastic Substrates Made by LPKF-LDS® Technology 465
P. Buckmüller, W. Eberhardt, U. Keßler, H. Willeck, H. Kück

Fine Pitch Copper Wire Bonding Introduction to High Volume Production 470
B. Appelt, A. Tseng, Y.-S. Lai

Enabling High Volume Copper Wire Bonding With Enhancements to Process and Equipment Capability 475
J. Foley, B. Chylak, H. Clauberg

Elastic Properties of Bonding Wires 479
C. Dresbach, M. Mittag, P. Matthias

ASSEMBLY AND MANUFACTURING TECHNOLOGY (AM-5) – SUBSTRATES

Frames, Cavities & Channels – Advanced Mechanical Structures in PCBs 483
C. Lehnberger

Novel Hermetic and Low Cost Glass-Capping Technology for Wafer-Level-Packaging of Optical Devices 486
U. Hansen, S. Maus, J. Leib, M. Toepper

Benefits of Pure Palladium for ENEP and ENEPIG Surface Finishes 491
M. Özkök, G. Ramos, D. Metzger, H. Roberts

ASSEMBLY AND MANUFACTURING TECHNOLOGY (AM-6) – INSPECTION AND TEST

Ceramic Injection Molded Clevis Sensor for Online Substance Concentration Measurement 497
M. Hartmann, S. Doerner, S. Hirsch

Inspection of Through Silicon Vias (TSV) in IC Packages by Computed Tomography 501
H. Roth, Z. He, T. Mayer

Changes of the Coplanarity of SMT-Components during Soldering and their Measurement 505
H. Wohlrabe, K.-J. Wolter

Report on iNEMI Boundary Scan Adoption Project Results and Future Plans 511
G. O'Malley, H. Fu, P. B. Geiger, S. Butkovich

MICROSYSTEM PACKAGING (MP-1) – SENSOR INTEGRATION ISSUES

In-situ Test Structures for Ultra Low Leak Detection 517
S. Millar, M. Desmulliez, S. McCracken, S. Cargill

Hermeticity of Eutectic Bond Layers for Sensor Packages on Wafer-Level 521
A. Schneider, H. Rank, R. Müller-Fiedler, O. Wittler, H. Reichl

Fluxless Wafer Level Cu–Sn Bonding for Micro- and Nanosystems Packaging 526
N. Hoivik, K. Wang, K. Aasmundtveit, G. Salomonsen, A. Lapadatu, G. Kittilsland, B. Stark

MICROSYSTEM PACKAGING (MP-2) – MICROSYSTEM PACKAGING

Future High Security ID-Documents Based on Innovative Micro System Technologies 531
J. Kloeser, D. Holinski, A. Ferber, O. Muth, J. Fischer, M. Paeschke

Biocompatibility Assessment of Advanced Wafer-Level Based Chip Encapsulation 536
E. Dy, M. Op De Beeck, R. Vos, A. La Manna

Influence of Accelerated Aging on the Acoustic Properties of a Ceramic Microsystem for Structural Health Monitoring 540
S. Hildebrandt, B. Boehme, K.-J. Wolter

Polymer Bonding by Induction Heating for Microfluidic Applications 545
B. J. Knauf, C. Liu, D. Patrick Webb, P. P. Conway

MICROSYSTEM PACKAGING (MP-3) – PROCESSES

3D Welding of Ultrathin Pt Wires by Joule Heating 553
S. Fukui, H. Tohmyoh, M. Saka

Aerosol Printed High Definition Co-Fired Metallization Lines for LTCC-Packages 557
U. Partsch, S. Mosch, M. Ihle

Low Cost Thin Film Packaging for MEMS Over Molded 563
J.-L. Pornin, C. Gillot, C. Billard, E. Lagoutte, M. Pellat, G. Parat, N. Sillon

Characterization of Surface Profile for Surface Activated Bonding by Using Power Spectral Density Function 567
K. Tsukamoto, T. Suga

NEW MATERIALS AND PROCESSES (NM-1) – DIE ATTACH

Die-Attach for High-Temperature Applications Using Fineplacer-Pressure-Sintering (FPS) 571
J. Kähler, A. Stranz, N. Heuck, G. Palm, A. Waag, E. Peiner

Investigations on Zn-Al-Ge Alloys as a High Temperature Die Attach Material 576
A. Haque, Y. S. Won, A. S. M. A. Haseeb, H. H. Masjuki

New Silver Contact Pastes - From High Pressure Sintering to Low Pressure Sintering 581
W. Schmitt

Anisotropic Thermal Conductivity in Electrically Conductive Adhesives with Single- and Bimodal Filler-Size Distributions Containing Ag Flakes and Micro-Particles 587
M. Inoue, J. Liu, H. Muta, S. Yamanaka

NEW MATERIALS AND PROCESSES (NM-2) – MATERIAL ANALYSIS

A Novel Approach for Reliability Assurance of Solder Pastes Against Dew Condensation 593
J. Franke, C. Matzner, M. Rösch

Spherical Polymer Particles in Isotropic Conductive Adhesives - A Study on Rheology and Mechanical Aspects 597
Hoang-Vu Nguyen, H. Kristiansen, J. Gakkestad, R. Johannessen, N. Hoivik, K. Aasmundtveit

Water Diffusion in Micro- and Nano-Particle Filled Encapsulants 603
T. Braun, J. Bauer, L. Georgi, K.-F. Becker, M. Koch, V. Bader, R. Aschenbrenner, H. Reichl

Properties of High-k Materials Embedded in Low Temperature Cofired Ceramics 610
H. Bartsch, J. Müller, R. Grieseler, S. Barth, B. Pawlowski

NEW MATERIALS AND PROCESSES (NM-3) – MATERIAL DEPOSITION

Characterisation of Silver Particles Used for the Low Temperature Joining Technology 615
C. Früh, M. Günther, M. Rittner, M. Nowottnick, A. Fix

Aerosol Deposition of Catalytic Ink to Fabricate Fine Pitch Metallizations for Moulded Interconnect Devices (MIDs) 620
A. Brose, T. Leneke, S. Hirsch, B. Schmidt

Rapid Prototyping of Electronic Modules Combining Aerosol Printing and Ink Jet Printing 624
H. Gieser, H. Wolf, D. Bonfert, H. Hengelmann, V. Zöllmer, C. Werner, G. Domann, J. Bahr, B. Curran, I. Ndip, K. Bock, F. Oehler, H. Milosiu

Influence of Nano Silver Filler Content on Properties of Ink-Jet Printed Structures for Microelectronics 630
T. Falat, J. Felba, A. Moscicki, A. Smolarek, K. Bock, D. Bonfert

NEW MATERIALS AND PROCESSES (NM-4) – SOLDERING PROCESSES

Newly Developed Low Cost, Reliable Wafer Level Hermetic Sealing Using Cu/Sn System 635
D. Q. Yu, M. L. Thew

Nanoscaled Solder for Low-Temperature Assembling Processes 640
A. Novikov, M. Nowottnick

Electrolytic Solder Deposit for Next Generation Flip Chip Solder Bumping 645
B. Roelfs, S. Kenny, K. Matejat

NEW MATERIALS AND PROCESSES (NM-5) – NANOMATERIALS

Nano Materials for Microelectronic Packaging 650
C. P. Wong, R. Zhang, W. Lin

Nanoporous Interconnects 654
H. Oppermann, L. Dietrich, M. Klein, B. Wunderle

Polymer Nanofiber Based Continuous Metal Phase Composite for Thermal Management Applications 658
B. Carlberg, J. Liu, L.-L. Ye

Surface Activated Bonding between Au Layer and Vertically Aligned Multi-Wall Carbon Nanotubes 664
M. Fujino, T. Suga, I. Soga, D. Kondo, Y. Ishizuki, T. Iwai, M. Masataka

NEW MATERIALS AND PROCESSES (NM-6) – MATERIALS CHARACTERIZATION

Thermomechanical Analysis of Electrically Conductive Adhesives 668
P. Mach, D. Bušek, R. Polanský
Use of Non-Etching Adhesion Promoters in Advanced PCB Applications 673
R. Massey, A. Zee
Anodic Bonding at Low Voltage Using Microstructured Borosilicate Glass Thin-Films 678
J. Leib, U. Hansen, S. Maus, H. Feindt, M. Toepper, K. Hauck, K. Zoschke

EMERGING TECHNOLOGIES (ET-1) – WEARABLES

Flipchip Bonding of Ultrahin Si Dies onto PEN/PET Substrates with Low Cost Circuitry 682
J. Van Den Brand, R. Kusters, B. Van Remoortere, A. Dietzel, M. Heeren
Fundamental Analysis of Embroidered Interconnections for Electronics in Textiles 688
T. Linz, S. Erik, H. Walter
Stretchable Electronics Manufacturing and Application 693
A. Ostmann, M. Seckel, T. Löher
Development of a Thin-Film Stretchable Electrical Interconnection Technology for Biocompatible Applications 699
R. Verplancke, T. Sterken, F. Axisa, J. Vanfleteren

EMERGING TECHNOLOGIES (ET-2) – DETECTOR/PV

Micro Electrode Array for Electrical Recording of Membrane Ionic Currents 703
A. Aryasomayajula, J. Derix, S. Perike, G. Gerlach, R. Funk
X-Ray Resistant Packaging for X-Ray Line Detectors 708
M. Oppermann, T. Lohse, R. Metasch, T. Zerna, K.-J. Wolter
Packaging Technologies for Photovoltaic Modules – Technological Challenges and Mechanical Integrity 712
S. Wiese, N. Betzl, D. Wald, F. Kraemer
Development of Charged Particle Detectors by Integrating Gas Amplification Stage and CMOS ASIC on Wafer Level 718
J. Kaminski, T. Baumgartner, K. Desch, O. Ehrmann, T. Fritzsch, T. Krautscheid, S. Mayer, M. Töpper

OPTOELECTRONICS (OE-1) – LIGHTING AND LASER

Microbench for Optical Pulse Picking from 4 GHz Pulse Trains by Mode Locking of DBR Lasers 722
A. Klehr, A. Liero, T. Hoffmann, J. Schulz, S. Schwertfeger, H. Wenzel, G. Erbert, W. Heinrich, G. Tränkle
Integrated LED Modules 726
M. De Samber, E. Van Grunsven, E. Eggink, W. Peels
Injection Moulded Lens Array for High Power LED Modules 732
E. Juntunen, A. Keränen, M. Paakkinen, V. Vuorinen, E. Tetri, L. Halonen, Veli Heikkinen
Integration of a Multifunctional and Multiwavelength Optical Sensor for Automotive Applications Using Surface Mountable Planar Optical Interconnects 738
A. Klein, A. Gerritzen, H. Schröder, H. Oppermann, D. Capello, N. Pallaro

OPTOELECTRONICS (OE-2) – DATA TRANSMISSION AND DISPLAY

Active Optical Flex Module for Ultra-Short Distance Data Applications 744
M. Immonen, J. Wu, P. Cheng, Y. H. Luo, H. He, W. Huang, J. X. Xu, T. Rapala-Virtanen
New Method for Head-up Display Realization by Mean of Chip On Board and Aerosol Jet Process 750
S. Padovani, S. Sinesi, S. Priante, M. Antonipieri, A. Del Negro, V. Zöllmer, M. Maiwald, M. Hedges
Microelectronic-like Packaging for Silicon Photonics: A 10 Gbps Multi-Chip-Module, Optical Receiver Based on Ge-on-Si Photodiode 753
S. Bernabé, C. Kopp, J.-M. Fedeli, L. Lombard

A Small Form-Factor and Low-Cost Opto-Electronic Package for Short-Reach 40 Gbit/sec Serial Speed Optical Data Links........ 758
J.-R. Kropp, J. A. Lott, N. N. Ledentsov, P. Otruba, K. Drögemüller, G. Fiol, D. Bimberg, I. Ndip, R. Erxleben, U. Maaß, M. Klein, G. R Lang, H. Oppermann, H. Schröder, H. Reichl

POWER ELECTRONICS (PE-1) – THERMAL ISSUES

Thermal Modeling for Advanced High Power Packaging Development and Online Performance Monitoring........ 762
C. Yuan, J. Salta, M. De Langen, W. Van Driel

Thermal and Mechanical Design Optimization of a Pressure-Mounted Base-Plate-less High Temperature Power Module........ 767
N. Mattey, R. Skuriat, J. Li, P. Agyakwa, C. M. Johnson, P. Evans

Thermal Optimisation of GaNFlip Chip Power Transistors........ 773
R. Zhytnytska, O. Hilt, V. Sidorov, J. Würfl, G. Tränkle

Power Cycling Tests at High Temperatures with IGBT Power Modules for Hybrid Electrical Vehicle Applications........ 776
A. Hensler, J. Lutz, M. Thoben, J. Zachariae

POWER ELECTRONICS (PE-2) - MATERIALS

Ceramic Substrates with Aluminium Metallisation for Power Application........ 782
H. Knoll, W. Weidenauer, P. Ingram, S. Bennemann, M. Petzold, S. Brand

Transfer Layer Technology for the Packaging of High Power Modules........ 787
M. Balucani, P. Nenzi, R. Crescenzi, L. Dolgyi, A. Klyshko, V. Bondarenko

Impact of Printed Circuit Board Technology on Thermal Performance of High-Power LED Assembly – Experimental Results........ 793
J. Nicolics, G. Langer, F. Lutschounig, K.-J. Lang, R. Huber

Integrated Magnetics on Silicon for Power Supply in Package (PSiP) and Power Supply on Chip (PwrSoC)........ 799
C. Ó Mathúna, N. Wang, J. Hannon, R. Foley, K. McCarthy, T. O'Donnell, K. Rodgers, F. Waldron

POSTERS

Label-free Chemical/Biochemical Sensing Device Based on an Integrated Microfluidic Channel within a Waveguide Resonator........ 805
E. McKeever, S. Pavuluri, R. Lopez-Villarroya, D. Kavanagh, M. Desmulliez, G. Goussetis, M. I. Mohammed

Surface Modification and Wettability of Silicone Polydimethylsiloxane Films........ 808
K.-Y. Wang, G.-M. Ouyang, X.-Y. Chen

Board Level Validation for Green IC Packaging with Strain-Controllable Dynamic Bending Method........ 811
J. C. Lee, C.-K. Yu, G. Chang, T. Shao, C. Chen, X.-K. Meng, M. Brown

New Facts from Lead-free Solders Reliability Investigation........ 817
I. Szendiuch, J. Jankovsky, M. Bursik, E. Hejatkova

FPGA-Board and Active Optical Cable Design for Optical Multi-Gigabit Communication........ 822
F. Merchán, K.-H. Brenner, P. Gregorius, S.-H. Voß

Fabrication and Test of Arrays of Langasite Microbalances........ 827
E. Ansorge, A. Brose, B. Schmidt, J. Sauerwald, H. Fritze

Testing and Simulation of Wire Bonding Attach for Higher Current........ 833
M. Bursik, E. Hejatkova, J. Jankovsky, M. Novotny, I. Szendiuch

Thermodynamic Sensors – New Opportunities for Measuring and Control in Industrial Applications........ 837
M. Reznicek, I. Szendiuch, Z. Reznicek

Organic Humidity Sensors - Improvement of Climatic Resistance........ 842
J. Reboun, A. Hamacek, T. Dzugan, M. Kroupa

Controlling the Signal Integrity Through the Geometry of the Microstrip on the Digital PCBs........ 847
M. Zolog, D. Pitica

Assembly Requirements for Multi-Channel Coupling Micro-Optics in Board-Level Optical Interconnects........ 853
K. Nieweglowski, R. Rieske, K.-J. Wolter

Properties and Growth of Intermetallics Formed During Thermal Aging of Cu-Al Ball Bonds........ 859
G. H. M. Gubbels, M. H. M. Kouters, O. O'Halloran, R. Rongen

Numerical Analysis of Microwave Underfill Cure in Ball-Grid Packages 865
T. Tilford, M. Ferenets, R. Adamietz, S. Pavuluri, J. E. Morris, M. Desmulliez, C. Bailey

On the Integration of Microwave Curing Systems into Microelectronics Assembly Processes 871
R. Adamietz, G. Müller, N. Othman, F. Eicher, T. Tilford, M. Ferenets, S. Pavuluri, M. Desmulliez, C. Bailey

Silver Nanocluster Formation Using UV Radiation for Direct Metal Patterning on Polyimide 877
D. E. Watson, J. Hoyd-Gigg Ng, M. Desmulliez, J. Sigwarth, J. Bates

Simulation and Parameter Optimization of Power DMOS Trench Field Effect Transistors 881
V. Baranov, A. Belous, M. Krechko, I. Roubtsevich, A. Tourtsevich

The Connecting of Electronic Modules Using SMD Components' Package 884
J. Sandera, O. Svecova

Electrical Characterization of PEDOT: PSS 888
S. Pretl, M. Kroupa, A. Hamacek, T. Dzugan, J. Reboun, J. Cengery

Epoxy Resin Curing Process Evaluation Based on Signal Frequency Analysis from Interdigital Structure Sensor 892
T. Blecha, J. Pihera

Determination of Maximum Strength and Optimization of LED Chip Structure 896
S.-Y. Yang, T.-L. Chou, C.-F. Huang, K.-N. Chiang, C.-J. Wu, C.-L. Hsu

Growth Behaviour of Gold-Aluminum Intermetallic Phases (IMP) in Temperature Aged Ball Bonds Observed by Electron Backscatter Diffraction 901
B. März, S. Scheibe, A. Graff, M. Petzold

Head on Pillow Defects in BGAs Solder Joints 905
A. Arazna, G. Koziol, W. Steplewski, K. Lipiec

Influence of Metallographic Preparation on EBSD Characterization of Cu Wire Bonds 909
T. Zerna, A. Tkachenko, M. Müller, K.-J. Wolter

Microstructure and Mechanical Properties of Laser Ablation Cleaned NiP-Platings for Aluminum Wire Bonding 914
S. Bennemann, C. Dresbach, G. Lorenz, L. Berthold, M. Petzold

Design and Implementation of an Integrated RF System-in-Package for Healthcare Applications 919
F. Wagner, N. Abo Elneel, D. Schroeder, W. Krautschneider

Investigation of Properties of the SAC Solder Paste with the Silver Nanoparticle and Carbon Nanotube Additives and the Nano Solder Joints 924
M. Jakubowska, W. Niedzwiedz, K. Bukat, M. Koscielski, J. Sitek, A. Mlozniak, M. Sloma

Local Stress Measurement Methods for Packaging Purposes– A Comparison 930
A. Gollhardt, D. Vogel, B. Michel

Fine Pitch Cu/Sn Solid State Diffusion Bonding for Making High Yield Bump Interconnections and its Application in 3D Integration 934
W. Zhang, P. Limaye, Y. Civale, R. Labie, P. Soussan

Characterization Methods for Determination of Temperature Depended Electrical, Thermal, Mechanical and Fatigue Properties of SnAg3,5 Solder 938
M. Roellig, R. Metasch, K. Meier, F. Alt

Through Silicon Via Polymer Filling for 3D-WLP Applications 949
M. Bouchoucha, P. Chausse, L. L. Chapelon, St. Moreau, N. Sillon

Reliability of Solder Joints Assessed by Acoustic Imaging During Accelerated Thermal Cycling 953
R. S. H. Yang, D. Harvey, Z. Guang-Ming, D. R. Braden

Reliability of Ag Ink Jet Printed Traces on Polyimide Substrate 959
R. Bonadiman, M. Salazar

Impacts of Uniaxial Mechanical Stress on High Frequency Performance of MOSFETs 964
Y.-G. Han, M. Koganemaru, W. Choi, H. Tomokage, T. Ikeda, N. Miyazaki

Backlight Illumination Structure Based on Inorganic LED Devices and Laminated Multilayer Polymer Substrate 969
K. Keränen, M. Heikkinen, J. Rekilä, A. Sunnari, M. Hiltunen, K. Rönkä, M. Lahti, J.-T. Mäkinen

An Integrated Approach to Design for Quality (DfQ) in the High Value Added Printed Circuit Assembly (PCA) Manufacturing: A Pilot Tool 973
L. A. Huertas-Quintero, P. P. Conway, D. M. Segura-Velandia, A. A. West

Influences of Soldering Processes on Piezoelectric Properties 979
S. Bramlage, S. Walter, K.-J. Wolter

Thermal Signal Behaviour for Air Flow Measurement as Fundamentals to Time-of-Flight 982
O. Ecin, E. Engelien, B. Strathen, R. Viga, B. Hosticka, A. Grabmaier, M. Malek, D. Gu

Boundary Condition Independent Multiple Cooling Surfaces Transient Compact Thermal Model 988
T. Azoui, P. Tounsi, J.-M. Dorkel

Progress Towards the Development of Novel Fabrication and Assembly Methods for the Next Generation of Ultrasonic Transducers 992
J. Hoyd-Gigg Ng, D. Flynn, Y. Lacrotte, M. Desmulliez, R. Ssekitoleko, C. Démoré, S. Cochran

DoE Simulations with the microDAC-Stress-Chip for Material and Package Investigations 998
F. Schindler-Saefkow, B. Wunderle, B. Michel, A. Otto, S. Rzepka, O. Wittler

RFID System for the Identification of Biological Samples 1002
K. Hichri, H. Zimmermann, F. Ihmig, H. Wick

Investigation of Misalignment in Microwave Multilayer Filters 1007
W. Ali, H. Bunyan

The Impact of Carbon Nanotubes Diameter on their Thermal Conductivity – Non-equilibrium Molecular Dynamics Approach 1011
B. Platek, T. Falat, J. Felba

Reliability Improvement of a Powder Blasting Process for Micro-Machining Applications 1015
Y. Lacrotte, S. Wilhelm, M. Desmulliez

New Packaging Concept for Ultra High Precision 3D Tactile Probes for CMM Applications 1019
S. Buetefisch, F. Solzbacher, H. U. Danzebrink, U. Brand, L. Koenders

Effects of Failure Criteria on the Constant Humidity Test Results 1023
K. Kokko, L. Frisk

Effect of Solder Diffusion Barriers on the Joint Reliability of SiC Power Devices Operated above 300°C 1027
F. Lang, H. Oohashi, H. Yamaguchi

Electron Transport in Tantalum Nanolayers: Application to Tantalum Capacitors 1032
M. Kopecký, M. Chvátal, V. Sedláková

Optimization of Lead-Free Wave Soldering Process Using Taguchi Orthogonal Arrays 1037
P. Mach, S. Barto, P. Zeman, E. Kotrcová

Introduction of Nanosized Al_2O_3 in Sn-Ag3,5 solders by Mechanical Alloying 1041
J. C. Boareto, G. Rodrigues, M. Mastropieto, P. A. P. Wendhausen, K.-J. Wolter

A Detailed Investigation of the Failure Formation of Copper Trace Cracks During Drop Tests 1046
F. Kraemer, S. Rzepka, S. Wiese, W. Faust, J. Lienig

Freeform Lens for White LEDs with High Angular Color Uniformity 1052
K. Wang, D. Wu, F. Chen, Z. Liu, X. Luo, S. Liu

Investigation of Nano-Patterned PZT Thin Films by Piezoresponse Force Microscopy 1057
M. Waegner, M. Hoffmann, A. Haußmann, G. Suchaneck, G. Gerlach, L. M. Eng

Contactless Material Deposition by Jetting for Heterogeneous System Integration 1061
K.-F. Becker, A. Kurz, H. Reichl, M. Koch, J. Bauer, T. Braun

Fine-Line Structuring on LTCC-Substrates for HF-Components 1063
D. Stöpel, K.-H. Drüe, S. Humbla, M. Mach, T. Mache, A. Rebs, G. Reppe, G. Vogt, M. Hein, J. Müller

Board Design Optimization for Fine Pitch BGA Components 1069
A. Géczy, Z. Illyefalvi-Vitéz

Influence of Processing Conditions on Characteristics of LTCC Materials 1075
K. Makarovic, A. Meden, M. Hrovat, D. Belavic, J. Holc, M. Kosec

An IC-centric Biocompatible Chip Encapsulation Fabrication Process 1079
M. Op De Beeck, A. La Manna, T. Buisson, E. Dy, P. Soussan, C. Van Hoof, D. Velenis, F. Axisa

Analyses of Thermomechanically Related Failures of Raction IGBT Power Modules at Short Circuit Switching 1085
B. Nagl, J. Nicolics, W. Gschohsmann

Analysis of Vapor Phase Soldering in Comparison with Conventional Soldering Technologies 1091
Z. Illyefalvi-Vitéz , R. Bátorfi, P. Szoke, A. Géczy, M. Ruszinko

Liquid Crystal Polymer as a Substrate Material for Flip Chip ACA Interconnections 1096
L. Frisk, A. Parviainen, K. Kokko

A Simulation-Based Design Method to Transfer Surface Mount RF System to Flip-Chip Die Implementation 1102
L. Zheng, A. Mathewson, B. O'Flynn, M. Hayes, C. Ó Mathúna, K. Rodgers

Low Temperature Hybrid Bonding Using Self-Alignment 1107
J. H. Lee, T. H. Ha, C. W. Lee, C. D. Yoo, J. Y. Song

Investigation of Wettability and Interface Reactions of Sn-Pb, Sn-Ag-Pb and Sn-Ag-Cu Solders for Solar Cell Interconnections 1111
S. Schindler, S. Wiese

A Novel Approach to Embed Off-Chip RF Passives in PCB Based on Thin Film Technology 1115
L. Wang, W. Christiaens, S. Brebels, W. De Raedt, J. Vanfleteren

Rate Dependent Mechanical Behaviour of SAC Solder in Fast Tensile Experiments 1119
K. Meier, M. Roellig, S. Wiese, K.-J. Wolter

PCB Tracks Thermal Simulation, Analysis and Comparison to IPC-2152 for Electric Current Carrying Capacity 1125
R. Bunea, N.-D. Codreanu, C. Ionescu, P. Svasta, A. Vasile
Thermo Mechanical Behaviour of Dies in Multi Material Stacks 1129
M. Hintz, R. Dudek, I. Koch, F. Schindler-Saefkow, A. Steinke
Author Index