

# **International Conference on Soldering and Reliability 2009**

**Toronto, Ontario, Canada  
20-22 May 2009**

**ISBN: 978-1-61567-664-4**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2009) by Surface Mount Technology Association (SMTA)  
All rights reserved.

Printed by Curran Associates, Inc. (2009)

For permission requests, please contact Surface Mount Technology Association (SMTA)  
at the address below.

Surface Mount Technology Association (SMTA)  
5200 Wilson Road  
Suite 215  
Edina, MN 55424

Phone: (952) 920-4682  
Fax: (952) 926-1819

[www.smta.org](http://www.smta.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## **SESSION 1**

*Chair: Laura Turbini*

<b>GUIDELINES FOR ESTABLISHING A LEAD-FREE WAVE SOLDERING PROCESS FOR HIGH-RELIABILITY APPLICATIONS</b> .....	1
<i>J. Scott Nelson</i>	
<b>SOLDERING CHALLENGES IN A HALOGEN-FREE PCB ASSEMBLY PROCESS</b> .....	9
<i>Timothy Jensen, Ronald Lasky, Amanda Hartnett</i>	
<b>MOVING TOWARDS A STABLE PROCESS: MINIMIZING VARIATION IN SOLDER PASTE PRINTING</b> .....	14
<i>George Babka</i>	
<b>CREEP FRACTURE MECHANISM OF PLATED-THROUGH-HOLE(PTH) SOLDER JOINTS BASED ON PHYSICS-OF-FAILURE(PoF)</b> .....	21
<i>Won Sik Hong, Chul Min Oh, Noh Chang Park, Chang Woon Han, Byung Suk Song</i>	

## **SESSION 2**

*Chair: Bev Christian*

<b>VAPOURPHASE VACUUM-SOLDERING: A NEW PROCESS TECHNOLOGY OPENS TREMENDOUS PRODUCTION CAPABILITIES WHEN REFLOW-SOLDERING</b> .....	27
<i>Claus Zabel, Allen Duck</i>	
<b>HIGH QUALITY REFLOW SOLDERING WITH VAPOR PHASE THE NEW APPROACH OF VAPOR PHASE TECHNOLOGY</b> .....	30
<i>Andreas Flechtmann, Andreas Thumm</i>	
<b>HOT AIR SOLDER LEVELLING – A SOLUTION TO LEAD-FREE SOLDERABILITY PROBLEMS</b> .....	34
<i>Keith Howell, Keith Sweatman</i>	
<b>PREDICTING THE STRENGTH OF SOLDER JOINTS USING COHESIVE ZONE MODELING</b> .....	42
<i>Siva P. V. Nadimpalli, Jan K. Spelt</i>	
<b>PROBABILISTIC ASSESSMENT OF COMPONENT LEAD-TO-LEAD TIN WHISKER BRIDGING</b> .....	49
<i>S. McCormack, S. Meschter</i>	
<b>IMPACT OF REWORK ON RELIABILITY OF PLASTIC BALL GRID ARRAYS SUBJECTED TO MECHANICAL BEND TEST</b> .....	67
<i>Vikram Srinivas, Moustafa Al-Bassiyouni, Michael Osterman, Michael Pecht</i>	
<b>LEAD-FREE ASSEMBLY OF SERVER CLASS PCBAs: QUALIFICATION TRIAL RESULTS</b> .....	73
<i>Matthew Kelly, Marie Cole, Jim Wilcox, David Braun</i>	

## **SESSION 3**

*Chair: Polina Snugovsky*

<b>ADDRESSING THE CHALLENGE OF HEAD-IN-PILLOW DEFECTS IN ELECTRONICS ASSEMBLY</b> .....	81
<i>Mario Scalzo</i>	
<b>EFFECT OF SILVER IN COMMON LEAD-FREE ALLOYS</b> .....	86
<i>Ranjit Pandher, Tom Lawlor</i>	
<b>RELIABILITY OF SAC305 AND Sn3.5Ag SOLDERS UNDER HIGH TEMPERATURE THERMAL CYCLING</b> .....	101
<i>Elviz George, Diganta Das, Michael Osterman, Michael Pecht</i>	
<b>SOLDER JOINT MICROSTRUCTURE AND RELIABILITY STUDY OF PLASTIC BALL GRID ARRAY (PBGA196) AND MICRO LEAD FRAME (MLF) COMPONENTS IN LEAD FREE PROCESSES</b> .....	108
<i>S. Bagheri, P. Snugovsky, Z. Bagheri, C. Hamilton, H. McCormick</i>	
<b>CONTROL OF “SPALLING” IN SAC PB-FREE SOLDER ALLOYS WHEN USED WITH A Ni SUBSTRATE</b> .....	119
<i>L. Snugovsky, D.D. Perovic, J.W. Rutter</i>	

## **SESSION 4**

*Chair: Matthew Kelly*

<b>EFFECT OF ASSEMBLY VARIATIONS ON PACKAGE ON PACKAGE RELIABILITY IN THERMAL CYCLING</b> .....	125
<i>Heather McCormick, Jimmy Chow, Mike Berry, Joel Trudell, Russell Brush, Jie Qian, Roden Cortero</i>	
<b>CONFESSIONS OF A NEOPHYTE IN TEMPERATURE PROFILING A BATCH REFLOW OVEN</b> .....	134
<i>Bev Christian</i>	
<b>RELIABILITY ASSESSMENT OF ALTERNATIVE LEAD-FREE ALLOYS USED DURING WAVE AND REWORK</b> .....	141
<i>Craig Hamilton, Polina Snugovsky, Teng Hoon Ng, Juthathip Fangkangwanwong, Mario Moreno, Matthew Kelly, Jim Bielick</i>	
<b>FLUID FLOW MECHANICS – NEW ADVANCES IN LOW STANDOFF CLEANING</b> .....	154
<i>Sinisa Aleksic, Umut Tosun, Harald Wack, Joachim Becht</i>	
<b>THE USE OF SEGREGATED HYDROFLUOROETHERS AS CLEANING AGENTS IN ELECTRONICS PACKAGING APPLICATIONS</b> .....	164
<i>Philip G. Clark, Erik D. Olson, Hiromi Kofuse</i>	
<b>ELECTROPLATE BUMPING WITHOUT PHOTORESIST AND SI DICE STACKING WITH TSV FOR 3D PACKAGING</b> .....	169
<i>Jiheon Jun, Inrak Kim, Younggon Lee, Jae Pil Jung, Sungjun Hong, Y. Norman Zhou</i>	

## **SESSION 5**

*Chair: N/A*

<b>THERMAL CYCLE TESTING OF PWBS – METHODOLOGY</b> .....	175
<i>Michael Freda, Paul Reid</i>	
<b>WATER JET CUTTING FOR CROSS SECTIONING AND DE-PANELLING APPLICATIONS</b> .....	187
<i>Alex Kaldor, A.C. Rinella, Bev Christian</i>	
<b>NANOBOND® ASSEMBLY – A RAPID, ROOM TEMPERATURE SOLDERING PROCESS</b> .....	191
<i>Greg Caswell</i>	
<b>EVALUATION OF THERMAL STRESS IN A FLIP CHIP PACKAGE BY HYBRID EXPERIMENTAL-ANALYTICAL METHOD</b> .....	197
<i>A. Shirazi, H. Lu, A. Varvani-Farahani</i>	

## **ALTERNATE PAPERS**

*These Technical Papers Were Not Presented at the Conference*

<b>FINE FEATURE STENCIL PRINTING 0.3MM PITCH COMPONENTS</b> .....	204
<i>Chris Anglin, Ed Briggs, Ron Lasky, Dave Connell</i>	
<b>PROCESS CHALLENGES AND SOLUTIONS FOR EMBEDDING CHIP-ON-BOARD INTO MAINSTREAM SMT ASSEMBLY</b> .....	207
<i>Mukul Luthra</i>	
<b>Author Index</b>	