Center Research Projects Spring-Review

September 15-16, 2010
Auburn University Hotel & Conference Center
Agenda

WEDNESDAY, September 15, 2010

8:00-8:30 Continental Breakfast
8:30-8:35 Welcome and Introductions
Pradeep Lall, Thomas Walter Professor and Center Director, Mechanical Engineering

8:35-8:45 NSF Comments
8:45-9:45 Center Overview & Status
Pradeep Lall, Thomas Walter Professor and Center Director, Mechanical Engineering

9:45-10:00 Break

10:00-11:45 **Chip-Level Interconnects, Flip-Chip and Underfills**
Area Leader: Jeff Suhling, Mechanical Engineering

- P07-201 Harsh Environment Reliability of Underfilled Area Array Flip-Chip Devices
- P07-203 Die Stresses and Failure Progression in Microprocessor Packaging
- P06-201 The Effects of Environmental Exposures on Underfill Behavior and Flip Chip Reliability
- P08-201 Models for Underfill Stress-Strain and Failure Behavior with Aging Effects

11:45-12:00 Break

12:00-1:15 Lunch, Auburn University Hotel & Conference Center, Governer's Room

1:15-3:00 **Component Reliability and Prognostic Health Management Systems**
Area Leader: Pradeep Lall, Mechanical Engineering

- P09-101 Leadfree Part Reliability, Crack Propagation and Life Prediction under Extreme Environments
- P09-102 PHM for Field-Deployed Electronics Subjected to Multiple Thermal Environments
- P09-103 Development of Acceleration Factors and Closed-Form Life Prediction Models for Leadfree Packaging

	P09-104	Virtual Qualification of Leadfree Area-Array and Perimeter Packaging
	P09-105	Reliability Models for Interconnects and Interfaces in Leadfree Electronics subjected to Shock and Vibration

3:00-3:15 Break

3:15-5:00 **Connectors, and System-Level Interconnects: Degradation and Wear Mechanisms**
Area Leader: George Flowers, Mechanical Engineering

P08-403	Theoretical and Experimental Investigation on Fretting Corrosion and Thermal Degradation for Hybrid and Electric Vehicles
P08-404	Compliant Pin/Press Fit Technology
P08-405	Modeling and Analysis of a Connector System for Vibration-induced Fretting Corrosion
P08-409	Vibration Based Interfaces for Information Transmission
P09-401	Sn Whisker Growth from Sputtered SAC 305 Film on Brass
P09-402	Mitigation of Sn Whisker Growth Using a Ni Underlayer
P09-403	Whisker Growth During Exposure to Controlled Humidity
P09-404	Sn Whiskers Formed in Electric Fields

5:00-5:15 Break

5:15-6:15 Project Posters and Demonstrations

Posters: Component Reliability and Prognostic Health Management Systems
Area Leader: Pradeep Lall, Mechanical Engineering

PCR and Ridge Regression Based Development of Norris- Landzberg Acceleration Factors and Goldmann’s Constants for Lead free Electronics
- Dinesh Arunachalam (ME)
Assessment of PHM Algorithm Robustness for Electronics Applications
- Ryan Lowe (ME)
Prognostic Health Management eTool
- Ryan Lowe (ME),
Join Discussion on the CAVE^3 Blog
- Ryan Lowe (ME)
Decision Framework for Redeployment of Electronics in Multiple Envts based on Damage Pre-Cursors
- Rahul Vaidya (ME), Vikrant More (ME)
Vibration Testing of Ceramic Area-Array Micro-Coil Springs
- Dhananjay Panchagade (ME)

Board Trace Fatigue Models
- Arjun Angral
CAVE^3 Online Simulation Tools
- Aravind Sridhar (ME)
Thermo-Mechanical Reliability Data of Low-Silver Leadfree Alloys
- Mahendra Harsha (ME), Robert Hinshaw (ME)
Thermo-mechanical Reliability and Thermal Performance of HEV Metal-Matrix System
- Mahendra Harsha (ME)
Prediction of Transient Dynamics Interface Damage for SnAgCu Leadfree Electronics under Shock-Impact
- Mandar Kulkarni (ME)
Life-Prediction Models for SnAgCu Leadfree Electronics under Shock-Impact
- Sandeep Shantaram (ME)
Acceleration Factors and Life Prediction Models for on-chip and off-chip Failure Mechanisms
- Dinesh Arunachalam (ME), Prathap Subramaniam (CSE)
Prognostics Framework to Assess Operational Readiness of BGA's For Re-Deployment in Thermo-Mechanical Environments
- Mahendra Harsha
Study of Crack Initiation and Propagation in Leadfree packages Under Multiple Thermal Environments
- Mahendra Harsha (ME)
Anomaly Detection in Electronic Systems Subjected to Drop and Shock
- Prashant Gupta (ME)

Posters: Chip-Level Interconnects, Flip-Chip and Underfills
Area Leader: Jeff Suhling, Mechanical Engineering

Creep Characterization and Modeling of Underfills for Microprocessor Packaging
- Nusrat J. Chhanda (ME)
Test Plan for Flip Chip on Laminate Die Stress Study
- Safina Hussain (ME)
Determination of Stress Measurement Accuracy With Piezoresistive Sensors
- Safina Hussain (ME), Mohammad Motalab (ME), Jordan Roberts (ME)
Isothermal Aging Effects on Underfill Creep Behavior
- Chang Lin (ME)
Isothermal Aging Effects on Underfill Stress-Strain Behavior
- Chang Lin (ME)
Effects of Heat Sink Clamping on Changes in The Microprocessor Die Stress
- Jordan Roberts (ME)

Die Stress Variation in Microprocessor Packaging Subjected to Long Term Thermal Cycling
- Jordan Roberts (ME)
Temperature Dependent Die Stresses in Microprocessor Packaging
- Jordan Roberts (ME), Safina Hussain (ME)
Development of Lamination Theory for STABLCOR Substrates
- Kun-Yen Wang (ME)

Posters: Connectors, and System-Level Interconnects: Degradation and Wear Mechanisms
Area Leader: George Flowers, Mechanical Engineering

Whisker Growth During Exposure to Controlled Humidity
- E. Crandall (Physics)
Sn Whiskers Formed in Electric Fields
- E. Crandall (Physics)
Mitigation of Sn Whisker Growth Using a Nickel Underlayer
- E. Crandall (Physics)
Sn Whisker Growth from Sputtered SAC305 Film on Brass
- E. Crandall (Physics)
Whisker Exoskeletons as Viewed by Real-Time Scanning Electron Microscopy
- E. Crandall (Physics)
Multiphysics/Multiscale Finite Element Model - 40 A Connector
- Santosh Angadi (ME)
Experimental Investigation of High Power Connector Reliability
- Rujian Fu (ME)
Multi-Physics FEM for High Power Connectors
- Robert Polchow (ME)
Modeling and Analysis of a Connector System for the Prediction of Vibration-induced Fretting Degradation
- Chen Chen (ME)
Combining Thermal and Vibrational Models to Analyze Fretting Corrosion
- Rebecca Ibrahim (ME), George Vallone (ME)

6:30	Dinner (Zazu Restaurant)

THURSDAY, September 16, 2010

8:00-8:30	Continental Breakfast
8:30-10:15	**Harsh Environment Electronics Systems** *Area Leader: John Evans, Industrial Systems Engineering*

P09-503	QFP Reliability on Powered and Non-powered Thermal Cycle Environment
P10-501	Reliability of aged lead-free solder for temperature accelerated life testing (TV7)
P10-502	Reliability of aged lead-free solder for mechanical accelerated life testing (TV7)
P10-503	Dip flux reliability for micro BGA packages (TV8)
P05-502	Measurement of Thermal Properties of an Epoxy/Alumina Composite
P10-504	Task Complexity Measurement and Video Training for Automated Equipment
P10-505	Design, Processing and Reliability Characterizations of a 3D-WLCSP Packaged Component

10:15-10:30 Break

10:30-12:15 **Leadfree Solders Alloys Constitutive and Wetting Behavior**
Area Leader: Mike Bozack, Physics

P09-301:	Melting Point Behavior of Mixed-Formulation Solders
P09-302:	Spreading Behavior of Mixed-Formulation Solders
P07-306:	Aging Behavior of Next Generation Pb-Free Alloys
P08-304	Extreme Low Temperature Behavior of Solders
P07-305:	Creep Behavior and Microstructure of Mixed Formulation Solder Joints
P08-305	Composition, Microstructure, and Reliability of Mixed Formulation Solder Joints

12:15-1:30 Lunch, Auburn University Hotel & Conference Center, Governer's Room

1:30-2:30 Project Posters and Demonstrations

Posters: Harsh Electronics Systems and Manufacturing
Area Leader: John Evans, Industrial Systems Engineering

Reliability of Lead-free BGA with Leaded Paste for Harsh Environment
- Tao Zhang (ISE)
Solder Joint Harsh Environmental Reliability Test on Continental GM Bending and Non-bending boards

- F. Xie (ISE)
QFP Reliability on Powered and non-powered thermal cycle Environment
- F. Xie (ISE)
In-Situ Environmental Testing for Solder Joint Reliability - Alternative Method (update)
- F. Xie (ISE)
Thermal Performance of Laminate-to-Aluminum Attachment Materials After Cycling
- Jack Maddox (ME), Roy Knight (ME), Sushil Bhavnani (ME), John L. Evans (ISE)
Measurement of Thermal Properties of an Epoxy/Alumina Composite
- John F. Maddox (ME)

Posters: Leadfree Solders Alloys Constitutive and Wetting Behavior
Area Leader: Mike Bozack, Physics

Preliminary Study of Aging and Dopants on Mechanical Properties of SAC Solders
- Zijie Cai (ME)
Effect of Aging on Tensile Properties of SACX
- Zijie Cai (ME)
Modeling of SAC Solder Behavior Using the Anand Viscoplastic Model
- Mohammed Motalab (ME)
Initial Study of SAC Cyclic Stress-Strain Behavior and Hysteresis
- Muhannad Mustafa (ME)
Mechanical Characterization of Solders at Cyrogenic Temperatures
- Muhannad Mustafa (ME), Zijie Cai (ME)
Modeling of Stress-Strain Behavior of Lead Free Solders
- Muhannad Mustafa (ME)
The Influence of Aging Conditions On The Mechanical Behavior SAC Solders
Yifei Zhang (ME)
100% In-Situ Studies of Mixed Formulation Solder Wetting
- M. J. Bozack (Physics), E. Crandall (Physics), and Y. Zhang (ME)
Microstructure Evolution of Mixed Formulation Alloys
- M. J. Bozack (Physics), E. Crandall (Physics), and Y. Zhang (ME)

2:30-2:45	Break
2:45-3:45	Industrial Advisory Board (IAB) Closed-Session
3:45-4:45	Feedback Session
4:45-6:30	Optional Topical Area Meetings (TBD)
6:30	Adjourn