cave3
NSF Center for Advanced Vehicle and Extreme Environment Electronics

Center Research Projects Spring-Review

March 31 - April 1, 2010
Auburn University Hotel & Conference Center
Agenda

WEDNESDAY, March 31, 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
P09-201	Characterization and Modeling of Advanced Substrates
P08-201	Models for Underfill Stress-Strain and Failure Behavior with Aging Effects
P07-203	Die Stresses and Failure Progression in Microprocessor Packaging (LGA)
P09-202	Insitu Die Stress Measurements in Flip Chip Packaging
P08-202	Modeling and Material Characterization for Flip Chip Packaging

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)*
FEA Predictions of Assembly Induced Die Stresses in Microprocessor Packaging
- *Mohammad Motalab (ME), Jordan Roberts (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)*
Vibration Based Interfaces for Information Transmission
- *Pregassen Soobramaney (ME)*
Simulation and Experimental Study on the Influence of Particulate Contaminants on Vibration-Induced Fretting Corrosion
- *Dr. Jinchun Gao (ME)*
Combining Thermal and Vibrational Models to Analyze Fretting Corrosion
- *Rebecca Ibrahim (ME), George Vallone (ME)*

6:30	Dinner (Zazu Restaurant)

THURSDAY, April 1, 2010

8:00-8:15 Continental Breakfast

8:15-8:45 Hybrid Electric Vehicle Systems and Components
Song-Yul Choe, Mechanical Engineering

8:45-9:00 Vehicle Survivability Analysis
David Beale, Mechanical Engineering

9:00-10:30 **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

10:30-10:45 Break

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

P07-306:	Aging Behavior of Next Generation Pb-Free Alloys
P08-304	Extreme Low Temperature Behavior of Solders
P08-305	Composition, Microstructure, and Reliability of Mixed Formulation Solder Joints
P09-303:	100% In-Situ Studies of Mixed Formulation Alloy Wetting
P09-304:	Microstructure Evolution of Mixed Formulation Alloys

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

QFP Reliability on Powered and Non-powered Thermal Cycle Environment
- *Fei Xie (ISE)*
Reliability of aged lead-free solder for temperature accelerated life testing (TV7)
- *Fei Xie (ISE)*
Reliability of aged lead-free solder for mechanical accelerated life testing (TV7)
- *Fei Xie (ISE)*
Dip flux reliability for micro BGA packages (TV8)
- *Fei Xie (ISE)*
Task Complexity Measurement and Video Training for Automated Equipment
- *Vic Uzumeri, John Evans, Richard Sesek, Jerry Davis*
Design, Processing and Reliability Characterizations of a 3D-WLCSP Packaged Component
- *Zhaozhi Li (ISE)*
In-Situ Environmental Testing for Solder Joint Reliability - Alternative Method (update)
- *F. Xie (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