

# **Failure Analysis of Electronics Short Course**

**Tuesday, November 1 – Thursday, November 3, 2011**

**Building 204, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark**

**[Click here](#) for Registration Information**

**Course Agenda**

## **Day One: Tuesday, 1<sup>st</sup> November 2011**

**8:30 AM– 9:00 AM:** Registration and Breakfast

**9:00 AM – 9:15 AM:** Introduction to the workshop, participants, and Course outline

**9:15 AM – 10:30 AM:** Introduction: Root Cause Analysis (Lecture)

**10 :30 AM-10 :50 AM :** Coffee Break

**10:50 AM – 11:50 AM:** Introduction: Micro Analysis; Sectioning/Mounting (Lecture)

**11:50 AM – 12:50 PM:** Lunch

Introduction to CALCE, Buehler, and CELCORR (Presentations during lunch)

**12:50 PM – 2:40 PM:** Laboratory Session – I:

Group I: Introduction to non-destructive analysis (macroscopy, optical microscopy, XRF and X-ray tutorial)

Group II: Sample preparation: cutting and mounting

**2:40 PM -3:00 PM:** Coffee Break

**3:00PM – 4:40 PM:** Laboratory Session – II:

Group I: Sample preparation: cutting and mounting

Group II: Introduction to non-destructive analysis

**Day Two: Wednesday, 2<sup>nd</sup> November 2011**

**8:45 AM– 9:00 AM:** Coffee

**9:00 AM – 10:20 AM:** Physics of Failure (PoF); Non-Destructive Techniques (Lecture)

**10:20 AM – 10:40 AM:** Coffee break

**10:40 AM – 12:20 PM:** Laboratory Session – III:

Group I: Inspection techniques (scanning electron microscopy, energy dispersive spectroscopy, electrical characterization techniques)

Group II: Sample preparation: grinding, polishing and etching

**12:20 PM – 1:20 PM -** Lunch

**1:20 PM – 2:40 PM:**

Grinding/Polishing (Lecture)

**2:40 PM - 3:00 PM:** Coffee Break

**3:00PM – 4:40 PM:** Laboratory Session – IV:

Group I: Sample preparation: grinding, polishing and etching

Group II: Inspection techniques

## Day Three: Thursday, 3<sup>rd</sup> November 2011

**8:45 AM– 9:00 AM:** Coffee

**9:00 AM – 10:40 AM:**

Failure mechanisms: Corrosion related failures, decapsulation, and mechanical testing

**10:40 AM – 11:00 AM –** Coffee break

**11:00 AM – 12:40 PM -** Laboratory Session – V:

Group I: Ion chromatography, electro-chemical analysis, and chemical decapsulation

Group II: Thin sectioning, vibratory polishing, and hand polishing

**12:40 PM – 1:40 PM:** Lunch

**1:40 PM – 3:00 PM:**

Etching, vibratory polishing cross sectioning of micro-components, thin sectioning (Lecture)

Miscellaneous analysis techniques (Lecture)

**3:00 PM - 3:20 PM:** Coffee Break

**3:20PM – 4:40 PM:** Laboratory Session – VI:

Group I: Thin sectioning, vibratory polishing, and hand polishing

Group II: Ion chromatography, electrochemical testing, and chemical decapsulation

**4:40PM – 5.00PM:** Summary and concluding remarks

**For additional information, please contact:**

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## Instructor Bios

### Instructors from Center for Advanced Life Cycle Engineering (CALCE)



**Dr. Michael H. Azarian** is a research scientist and member of the graduate faculty at the Center for Advanced Life Cycle Engineering (CALCE) at the University of Maryland. He holds a Masters and Ph.D. in Materials Science and Engineering from Carnegie Mellon University, and a Bachelors degree in Chemical Engineering from Princeton University.

His research focuses on the analysis, detection, prediction, and prevention of failures in electronic products. He has advised many companies on reliability of electronic products, and is the author or co-author of numerous publications on solder joint degradation, electrochemical migration, capacitor reliability, electronic packaging, and tribology. He is on the editorial advisory board of *Soldering & Surface Mount Technology*, and has served as technical editor of several IEEE reliability standards. He holds 5 U.S. patents for inventions in data storage and contamination control. Before joining CALCE, he spent 13 years in the disk drive, advanced materials, and fiber optics industries.

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**Mr. Bhanu Sood** is the Director of the Test Services and Failure Analysis (TSFA) Laboratory at the Center for Advanced Life Cycle Engineering (CALCE), University of Maryland. He received M.S. degrees in advance material processing and materials science from National Technical University and George Washington University respectively. His research areas include, investigation of failure mechanisms in electronics, supply chain impact on electronics reliability and counterfeit electronic parts detection techniques. Prior to joining CALCE in 2005, Mr. Sood worked at U.S. Naval Research Laboratory, where he developed embedded electronic circuits using laser-assisted prototyping techniques. Mr. Sood has developed and taught industry courses in the areas of electronics reliability, root cause failure analysis techniques and counterfeit electronics. He has authored scholarly and technical papers in the areas of root cause failure analysis methodologies, PCB failure mechanisms, embedded electronics, and topics on instrumentation. Mr. Sood is a member of IEEE and ASM.

### Instructors from Buehler



**Mr. Nanu M Vahora** presently works as a Materials Engineer for Buehler/A Division of Illinois Tool Works, Inc., has a Master Of Science Degree from Gujarat University, India with a background in Chemistry. He has 34 years of experience which includes more than five years with Buehler as a Materials Engineer, eight years in Microwave

Integrated Circuits for Space Satellite and Ground Station Application with Indian Space Research Organization (Government of India Space Program), ten years in Circuit Boards for high frequency, four years in Automobile Metallographic analysis and seven years in Health Care industries. His professional duty with Buehler includes customer service, research and development on new product and customer training. He was awarded two United States Patents (5, 891, 527 and 5, 891, 528) on April 6, 1999.



**Mr. Patrick Voos**, born in 1979, heads the application laboratory of the Buehler GmbH in Dusseldorf. He completed his studies of Material Science at the IHK, Cologne and worked at the Deutz AG for 4 years. Then he joined AIMT for 2 years in quality control for surface treatments. Since 2001 Patrick is responsible for the development of new preparation techniques in the Buehler GmbH laboratory and supports customers with application questions in Germany and abroad. Another key area of his work is the execution of metallographic seminars.

### **Instructor from Technical University of Denmark**



**Rajan Ambat**: Presently Associate Professor in the Department of Mechanical Engineering at Technical University of Denmark and Centre Manager for “Centre for Electronic Corrosion (CELCORR)” and “Consortium for Climatic Reliability of Electronics (CreCon)”. He obtained his PhD from Indian Institute of Science followed by EPSRC Research fellow at University of Birmingham, UK, and worked in collaboration with Airbus, BAE systems, Alcan International, and Jaguar. His current research activities involve corrosion reliability of electronic devices, high resolution electrochemical measurements and test methods for electronic corrosion, and corrosion resistant, optical designed, and functional coatings using aluminium. He teaches courses on materials in advanced applications and products including materials for PCB assembly, micro-circuits and MEMs, PCB manufacturing, and corrosion issues. He has published number papers of climatic reliability of electronics and advised companies on their reliability issues. He is a member of Electrochemical Society, USA, and Editorial Board member of “Corrosion Engineering, Science, and Technology” Journal of IOM<sup>3</sup>, UK.

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**Morten S. Jellesen**: Presently he is a Senior Scientist in the Department of Mechanical Engineering, DTU. He holds a Ph.D. degree from the Department of Manufacturing Engineering and Management, DTU followed by post-doctoral research. Presently his research activities are focussed on climatic reliability of electronics with close involvement in the management of Centre for Electronic Corrosion.