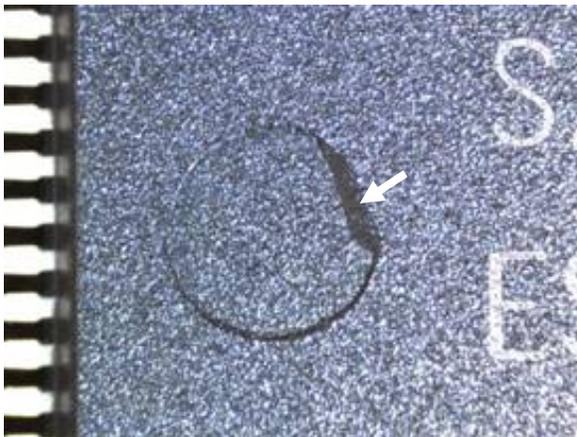


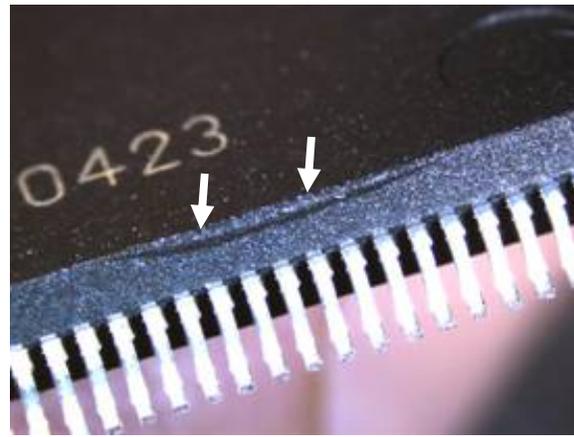
## **Counterfeit Electronics Components: Avoidance and Detection**

**Bhanu Sood and Dr. Diganta Das, CALCE, University of Maryland**

Counterfeit electronics components continue to make news. In recent years, the prevalence of these fake parts has only increased, with reports of parts discovered in military systems, medical devices and process control equipment. This increased risk has not only focused the spotlight on counterfeit component detection methods, but the ability of these techniques to uncover suspect parts that are produced using sophisticated counterfeit creation techniques.



**Mold indents, filled or blacktopped**



**Evidence of blacktop (overspray)**

There is NO alternative to good supply chain management as a defense against counterfeit parts. Much of the problem regarding counterfeit electronics is due to lack of due diligence by the part buyers. Understanding of the supply chain and assessing the supply chain before engaging them are necessary steps for any organization. Many types of products that have to be manufactured and supported for long periods of time lack control over critical parts of their supply chain, e.g., avionics and space, telecom infrastructure, and industrial controls. As a result, the components and technologies that these products depend on become obsolete long before the product's field life (and sometimes manufacturing life) ends.

### **Couse Outline**

This two day workshop begins with an introduction to the electronic parts supply chain, part supplier assessment methods and the sources of authorized and unauthorized parts. The counterfeit detection techniques discussion starts with an introduction to the diverse counterfeit part creation techniques. Next, a detailed discussion on detection techniques and procedures is presented. These techniques, categorized as non-destructive, destructive and analytical will be illustrated by means of pertinent data and case studies from past inspection of suspect parts. Part of the second day of the workshop will be spent in the CALCE Laboratory, where instructors will illustrate the use of relevant equipment such as x-ray, x-ray fluorescence, optical inspection, solvent test, acoustic microscopy, electrical tests and other pertinent techniques. Included in this section are discussions of minimum level of inspection, sampling plan based on risk, and reject

criteria. Attendees will also get an overview of the certification and training requirements for each inspection technique. The techniques are based on the AS6171 Aerospace Standard (currently in draft) which standardizes the test and inspection procedures, workmanship criteria, and minimum training and certification requirements to detect counterfeit electrical, electronic, and electromechanical parts. The standard ensures consistency across the supply chain for test techniques and requirements based on assessed risk of the application, component, supplier, and other relevant risk factors. At the end, authentication tools (such as DNA marking, dye pigments and barcodes) will be discussed.

What are counterfeit electronic parts?

General History of counterfeit electronic components

Electronic Part Supply Chain

- Participant
- Evolution

Assessment of Electronic Part Manufacturers and Parts

Assessment of Electronic Part Distributors

- Methods and Case Study
- Standards

How to Assess and Utilize Process Change Notices

- Introduction and examples
- Use in counterfeit detection

Counterfeit part related prosecutions – two case studies

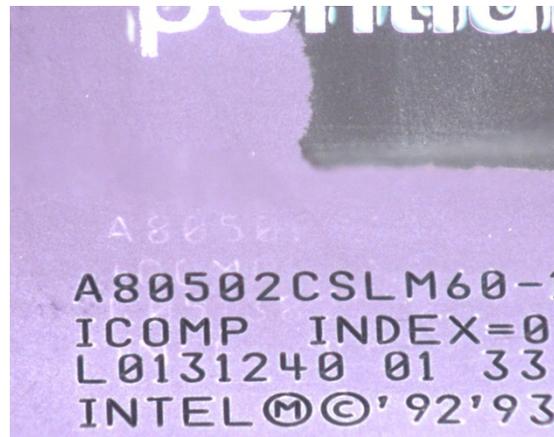
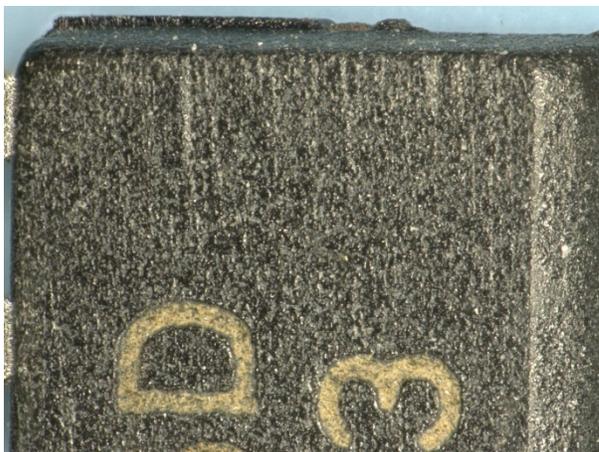
Counterfeit part detection techniques

- Non-destructive
- Materials Characterization Techniques
- Electrical Characterization
- Destructive techniques
- How to effectively engage a test lab to perform counterfeit detection testing

Laboratory demonstrations

Use of Authentication Tools and Taggants

SAE Counterfeit Related Standards



**Visible scratch marks or unidirectional abrasions**

**Previous marking partially visible on the package**

The full day workshop begins with an introduction to the electronic parts supply chain and the sources of counterfeit parts. Attendees will learn about the status of the electronic part distribution market and how this market has changed over the past decades. A primer on the diverse counterfeit part creation techniques will be provided. The rest of the workshop provides detailed instruction on various non-destructive techniques, destructive and analytical steps for inspecting suspect counterfeit parts.

### **Who Should Attend?**

Component Engineers	Failure Analysis Engineers
Reliability Engineers	Engineering Managers
Procurement Managers	Quality Assurance functions
Contracts Personnel	Supply chain managers
Design engineers	Logistics managers
Policy makers on counterfeit prevention	DMSMS managers
System sustainment organizations	Legal professionals
Engineers in electronic part selection and management groups	



**Dr. Diganta Das**, is a member of the research staff at the Center for Advanced Life Cycle Engineering. Dr. Das is the organizer of the most trusted event in fighting counterfeit electronics in the United States and with SMTA he had organized 10 conferences with large participation of industry, government, law enforcement, test laboratories and standards development organizations. He is a group leader for the SAE G-19 counterfeit detection standards group and has leading role in developing the standards. He has organized sessions in SAE's Aerospace Conference on counterfeit electronics. He has developed and taught courses on counterfeit electronics and helped develop training

material related to counterfeit electronics. He is the recipient of member of technical distinction award of SMTA for 2014 for his effort on counterfeit electronics prevention.

He is the foremost expert on electronic part tagging and tracking including authentication methods like DNA. He has worked with US Department of Defense in developing material characteristics based detection of counterfeit electronics. He works closely with US law enforcement community in awareness training for the industry.

His other research interests include electronic parts supply chain, part recycling and reuse, LED failure mechanisms, and power electronics reliability. Dr. Das has published more than 100 articles on these subjects.



**Mr. Bhanu Sood** is the Director of the Test Services and Failure Analysis Laboratory at the University of Maryland's Center for Advanced Life Cycle Engineering (CALCE). Mr. Sood's research at CALCE includes developing root-cause failure analysis and investigative techniques for electronic products, developing materials based strategies for counterfeit parts detection, and leading CALCE's efforts in understanding unique failure mechanisms in electronic assemblies.

Prior to joining CALCE in 2005, Mr. Sood worked as a Research Engineer at the U.S. Naval Research Laboratory, where he worked in the areas of 3D printing, printed micro-power sources, and laser-assisted stereo-lithography. Mr. Sood has authored over one hundred technical reports. His technical and scholarly publications cover topics such as electronic reliability, supply chain issues, lithium-ion batteries, embedded electronics, sensors systems, and instrumentation studies.

Mr. Sood has created and taught industry courses on topics such as root cause failure analysis, counterfeit part detection and prevention, electronics assembly, lithium-ion battery technology, product qualification testing, and RoHS/WEEE/REACH issues. These short courses have been given at client sites and at technical symposia hosted by organizations such as IPC, SMTA, IMAPS, NEPCON, SAE and ASM. Mr. Sood holds a US Patent on laser-based techniques for the transfer and embedding of electronic components and devices. He serves on the ASM Alloy Phase Diagram and Emerging Technologies Committees and is the chair of SAE G19A Radiological Committee. He is a senior member of IEEE and a member of SAE and ASM.