

# SAE AS6171

## G-19A-MISC – Miscellaneous Techniques Task Group

### Co-Chairs

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# Group Overview

## ❖ Charter

- ❖ Establish counterfeit detection techniques for higher risk applications
  - ❖ Develop test methods (TMs) beyond the conventional techniques
  - ❖ TMs not anticipated to be used for routine screening but rather to compliment routine screening if screening produces inconclusive results
  - ❖ Develop TMs to be used for applications that need in-depth analysis - techniques employed on an as-needed basis when the application cannot tolerate the risk of counterfeit parts

## ❖ Responsibilities

- ❖ Group is responsible for 13 TMs
  - ❖ TMs compare the composition or properties of an unknown sample to a part specification or a known authentic part

# Test Methods and Their Status

TM #	Test Method	Voting	Status
VII <sub>m</sub>	Design Recovery	Approved	Incorporating Comments
VII <sub>e</sub>	Raman Spectroscopy	Approved	Incorporating Comments
VII <sub>f</sub>	FTIR Spectroscopy	Approved	Incorporating Comments
VII <sub>j</sub>	Thermogravimetric Analysis (TGA)	In Ballot	Closes 7/18/13
VII <sub>i</sub>	Differential Scanning Calorimetry (DSC)		Final ballot review
VII <sub>k</sub>	Thermomechanical Analysis (TMA)		Final ballot review
VII <sub>h</sub>	Gas Chrom (GC) / Mass Spec (MS)		Final ballot review
VII <sub>a</sub>	Secondary Ion Mass Spectroscopy (SIMS)		Final ballot review
VII <sub>b</sub>	X-Ray Photoelectron Spectroscopy (XPS)		Interim Review
VII <sub>c</sub>	Auger Electron Spectroscopy (AES)		Interim Review
VII <sub>d</sub>	Ion Exchange Chromatography (IEC)		Draft
VII <sub>g</sub>	ICP/OES		Draft
VII <sub>l</sub>	Surface Profilometry		Draft

# Surface Sensitive Techniques

## SIMS, XPS, AES, & IEC

### ❖ SIMS

#### ❖ Capabilities

- ❖ Can determine chemical composition of outer surface of a sample
- ❖ Can analyze from first monolayer to a depth profile of 10's of microns

### ❖ XPS & AES

#### ❖ Capabilities

- ❖ Can provide elemental and chemical composition of 10nm into the surface of a sample
- ❖ Can detect all elements, except H and He

### ❖ Counterfeit Applications

- ❖ Can analyze inorganic and organic compounds, metals, alloys, semiconductors, catalysts, polymers, ceramics, paints, papers, inks, adhesives, etc.

# Surface Sensitive Techniques

## SIMS, XPS, AES, & IEC

### ❖ IEC

#### ❖ Capabilities

- ❖ Can detect and quantify anions, cations, and weak organic acids

#### ❖ Counterfeit Applications

- ❖ Can reveal handling history - detecting solder flux residues which may be indicative of prior use
- ❖ Can characterize extractable ions from polymers
- ❖ Can analyze liquid constituents of components such as batteries and electrolytic capacitors

# Surface/Bulk Sensitive Techniques

## Raman & FTIR

### ❖ Raman & FTIR

#### ❖ Capabilities

- ❖ Both techniques are similar in concept
- ❖ Both can analyze a surface layer or the bulk of a sample
- ❖ Both identify chemical bonds by measuring the vibrations within molecules
- ❖ Compliment each other - strong bands in IR tend to be weak in Raman and vice versa
- ❖ Can identify materials by determining the chemical “fingerprint” – unique materials produce unique spectra

#### ❖ Counterfeit Applications

- ❖ Can compare composition of a sample to a known authentic part, such as class of polymer, ink, coating, etc.
- ❖ Can also reveal handling history - detecting solder flux residues which may be indicative of prior use

# Bulk Analysis Techniques

## ICP/OES & GC/MS

### ❖ ICP/OES

#### ❖ Capabilities

- ❖ Can determine elemental compositions of materials to low ppb range
- ❖ Used for bulk analyses of metals, polymer, rubber, etc.

### ❖ GC/MS

#### ❖ Capabilities

- ❖ Can identify and quantify the volatile constituents of materials

### ❖ Counterfeit Applications for ICP/OES & GC/MS

- ❖ Alloy determination, RoHS compliance
- ❖ Can identify solvents used during part modification
- ❖ Can determine if two polymers are identical
- ❖ Can identify additive differences of polymers
- ❖ Can compare electrolytes

# Thermal Analysis Techniques

## DSC, TGA, & TMA

### ❖ Capabilities

- ❖ Can measure material properties as a function of temperature

### ❖ DSC

- ❖ Can determine Melt Point, Cure (T<sub>g</sub>), & Crystallization

### ❖ TGA

- ❖ Can provide Compositional Analysis & Moisture Content

### ❖ TMA

- ❖ Can determine Coefficient of Thermal Expansion (CTE), Cure (T<sub>g</sub>), Softening Point

### ❖ Counterfeit Applications for DSC, TGA, & TMA

- ❖ Can compare composition and/or physical properties of a sample to a known authentic part, such as plastic encapsulant, liquid electrolyte, lubricant, metal, or plating

# Physical Analysis Techniques

## Surface Profilometry & Design Recovery

### ❖ Surface Profilometry

#### ❖ Capabilities

- ❖ Can analyze the topography of a surface to quantify roughness
- ❖ Uses mechanical or optical probes

#### ❖ Counterfeit Applications

- ❖ Can be used to distinguish sanded and microblasted parts

### ❖ Design Recovery

#### ❖ Capabilities

- ❖ In-depth, fully destructive reverse engineering method

#### ❖ Counterfeit Application

- ❖ Can physically strip down a microcircuit and confirm design information
- ❖ Can determine whether the recovered design of a microcircuit matches the intended function or physical layout of the original design or a known authentic part

# Useful Website & Contact Info

## ❖ G-19A Website

[http://www.sae.org/servlets/works/postDiscussion.do?comtID=TEAG19A  
&docID=&resourceID=166788&inputPage=showAll](http://www.sae.org/servlets/works/postDiscussion.do?comtID=TEAG19A&docID=&resourceID=166788&inputPage=showAll)

## ❖ Misc Group Website

[http://www.sae.org/servlets/works/postDiscussion.do?comtID=TEAG19A  
&docID=&resourceID=196957&inputPage=showAll](http://www.sae.org/servlets/works/postDiscussion.do?comtID=TEAG19A&docID=&resourceID=196957&inputPage=showAll)

## ❖ Contact Info

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