

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 _m	Design Recovery	Approved	Incorporating Comments
VII _e	Raman Spectroscopy	Approved	Incorporating Comments
VII _f	FTIR Spectroscopy	Approved	Incorporating Comments
VII _j	Thermogravimetric Analysis (TGA)	In Ballot	Closes 7/18/13
VII _i	Differential Scanning Calorimetry (DSC)		Final ballot review
VII _k	Thermomechanical Analysis (TMA)		Final ballot review
VII _h	Gas Chrom (GC) / Mass Spec (MS)		Final ballot review
VII _a	Secondary Ion Mass Spectroscopy (SIMS)		Final ballot review
VII _b	X-Ray Photoelectron Spectroscopy (XPS)		Interim Review
VII _c	Auger Electron Spectroscopy (AES)		Interim Review
VII _d	Ion Exchange Chromatography (IEC)		Draft
VII _g	ICP/OES		Draft
VII _l	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_g), & Crystallization

❖ TGA

- ❖ Can provide Compositional Analysis & Moisture Content

❖ TMA

- ❖ Can determine Coefficient of Thermal Expansion (CTE), Cure (T_g), 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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