CMC laboratories
Innovative Material Solutions

CMC Laboratories, Inc.

Jonathan Harris (Presented to Sn Whisker Group October 12, 2016)

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www.CMClaboratories.com

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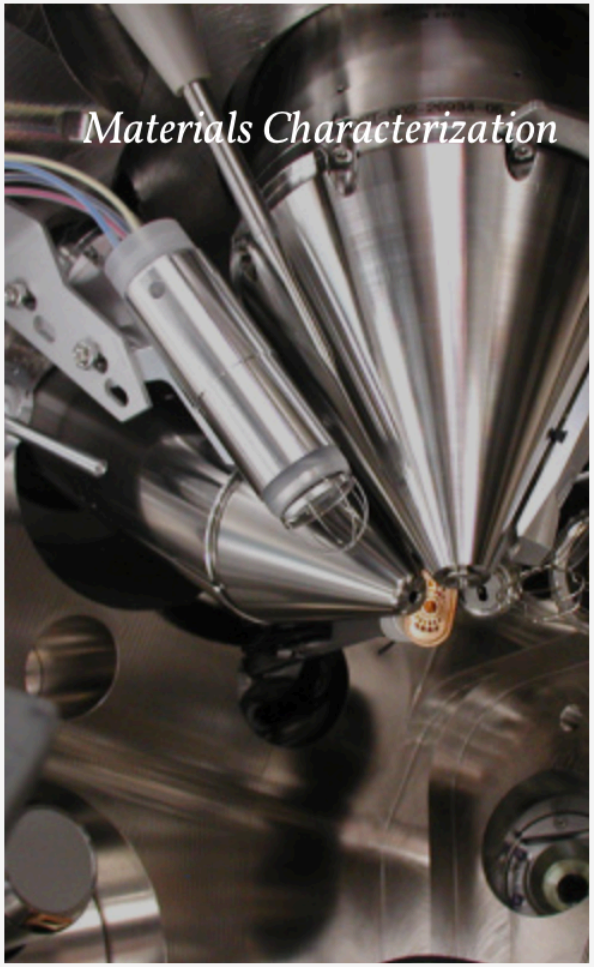

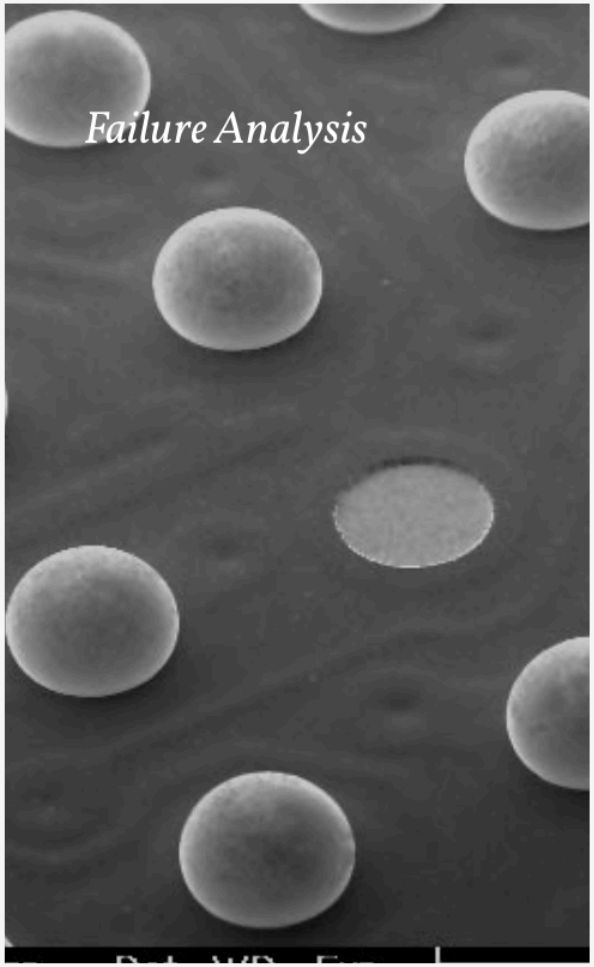

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CMC Business Overview

- Focus on Electronic Packaging and Assembly Technologies
- Failure Analysis focussed on root cause determination
- Materials Characterization
- Materials Consulting
- Focussed Development and Technology Licensing

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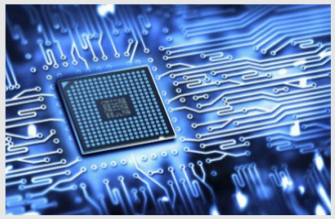
Industry Focus

- High Brightness LED
- Power Electronics
- Medical Electronics
- Packaging
- Microprocessor
- Aerospace
- RF and Microwave
- Automotive

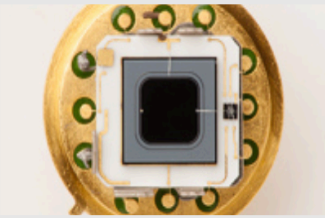


SEMICONDUCTOR

MEDICAL DEVICE

AUTOMOTIVE

MIL - AERO



OPTOELECTRONICS

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Services

Laboratory Services

Ion Milling / Polishing

Conventional mechanical sample prep techniques on highly stressed systems or very soft materials can introduce artifacts such as smearing, delamination, and/or edge relief that can distort the observations being made in an analysis.

CMC Laboratories has the ability to Ion Mill Section or perform an Ion Polish cleanup on a sample. This produces a high quality stress-free cross-section no matter what the material. Ion Polishing can also be used to etch a sample to delineate the grain structure or inter-facial layers in a material or system.

Energy Dispersive Spectroscopy (EDS)

CMC Laboratories has coupled a state of the art Energy Dispersive Spectroscopy (EDS) silicon drift detector (SDD) system with our Scanning Electron Microscope (SEM) system.

EDS analysis provides outstanding elemental identification with detection limits at ~0.1% with an area resolution of 0.5µm. CMC has the ability to produce very detailed compositional data for spots, area scans, line scans, and maps.

Real Time X-ray Analysis

Non-destructive analysis techniques are crucial in identifying defects prior to destructive analysis. CMC Laboratories' Real Time X-ray allows us to identify and isolate failure signatures like:

* Solder voiding
* Wirebond shorts
* Die attach issues
* PCB trace issues
* Internal package structure

Chemical / Mechanical Decapsulation

CMC Laboratories has developed proprietary chemical and mechanical techniques for removal of packaging material and de-lidding so that further analysis can be performed. CMC's techniques preserve the underlying structures which is imperative for subsequent analysis or testing.

Reactive Ion Etching (RIE)

Often the only way to remove certain organics, IDL, nitride, and oxide layers that are highly chemical resistant, while still maintaining the integrity of the IC, wirebonds, or circuitry is through dry etching.

At CMC Laboratories we use inductively coupled plasma etching, along with proprietary gas chemistries and etching profiles developed to remove specific layers while preserving surrounding layers of interest.

Metallographic Cross-sections

To get a full understanding of the construction of a sample or the mechanism of its failure, cross-sections are an invaluable tool.
At CMC Laboratories we have developed proprietary techniques that produce very high quality cross-sections of complex structures that are precise and defect free. In many cases, CMC's mechanical cross sections can achieve the same level of results as FIB, but over much larger areas.

CMC can also combine mechanical sections with ion milling to achieve much the same results as FIB sections.

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Precision Sub-Micron Cross-sections

The ultra-small architecture of modern ICs make producing precision cross-sections that target sub-micron defects extremely difficult. CMC Laboratories has the ability to target such defects with the precision of a FIB but the speed of traditional IC cross-sectioning. Our proprietary techniques have been developed while working with the worlds top companies for IC design and manufacturing. Combining precision mechanical techniques with Ion Mill Polish allows CMC to achieve FIB quality results over a larger cross-sectional area, and in a more cost effective way.

SEM Analysis and Imagining

Scanning Electron Microscopy is the core FA technique for providing images with high depth of field and contrast on the micron or sub-micron length scale.

CMC Laboratories' Immersion Lens FE-SEM is capable of 500,000x magnification with 0.5nm resolution and can operate at 500v-30kV. Coupled with our low kV Solid State Backscatter Detector we can produce images with contrast levels great enough to show differences in grain orientation. CMC can even output Ultra 4K quality images.

Prototype Plating

CMC Laboratories has a dedicated in house plating team and plating facility focused on developing solutions for challenging plating processes. CMC couples it's plating development capability with our Analysis Laboratory to develop robust plating solutions for our customers.

CMC has developed processing for plating difficult materials like LTCC, Rh, Diamond Aluminum, and more. CMC's plating laboratory has capability for electroless and electrolytic plating, and a wide range of activation processes. In addition to development, CMC also does select precision low volume production.

Competitive Analysis

A key service provided by CMC is construction analysis. This can be a highly useful tool in doing competitive analysis. Utilizing analytical techniques such as SEM cross section preparation and analysis, optical microscopy, EDS and X-ray analysis, CMC can determine how assemblies or components have been fabricated. Using microstructural information to understand fabrication processes is a key element of competitive analysis, and an area where CMC has a strong experience base.

Mechanical Testing

A key element in Failure Analysis is often understanding mechanical properties and failure modes. At CMC we have an Instron mechanical tester, and we offer a wide range of Mechanical Testing services including

* Tensile/Compression Testing
* Peel strength
* Wirebond Pull Strength
* Fracture Toughness
* Three Point Bending

These tests can be done on a wide range of materials, including ceramic, polymer and metal systems, as well as composites.

Image Analaysis

CMC Laboratories has the ability to quantitatively characterize the structure of a material system by analyzing optical and/or SEM images using specialized software.

At CMC we can use image analysis to characterize:

* Area percent distribution
* Layer thickness and distribution
* Grain size distributions
* Basic dimensions (radius, angle, length, area, etc)
* Apply image filters, gates, and windows
* Depth of field focus enhancement

Micro-Hardness Testing

CMC's micro hardness tester can provide localized hardness data for an individual macro-structure within a larger matrix. CMC has the ability to measure the hardness of ultra thin samples like cross sections, foils, plated layers, fibers, and passivation layers; as well as typical bulk properties of metals, ceramics, plastics, and glasses.

Our use of an electromagnetic force motor tester allows a workable load range from .05gf - 2kgf as well as the ability to vary dwell and load rates.

Laser Flash Thermal Conductivity

Thermal conductivity is one of the most critical parameters in characterizing how a material or component transports heat.

At CMC Laboratories we have developed a 30J Laser Flash measurement system that can take precise measurements of thermal diffusivity across a wide range of sample form factors and thicknesses. CMC 's laser flash, tied to NIST standards, represents a very rapid yet accurate method for determining thermal conductivities of materials between < 1 W/m-K up to >1000 W/m-K.

Materials Related Consulting

CMC provides a number of advanced materials related consulting services focussed on electronic packaging and assembly. These services include: technical process audits, working with customer's vendors to address critical process or quality issues, providing customized in-depth tutorials directed to engineering teams, and working with customer's in-house laboratories to determine root-cause of failures. These services can be performed at CMC or at the customer or vendors sites world-wide.

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The Valley's Premier Failure Analysis Laboratory, solving the problems of today for the technology of tomorrow.

QAS INTERNATIONAL
ISO 9001:2008
REGISTERED COMPANY
Certificate No. US3090

Advanced Materials Characterization

Root Cause Failure Analysis

Technology Process Development

13

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