

Serving Your Analytical Needs Since 1984

Spring 2002

IMR Charleston

In October 2001, IMR acquired the assets and on-going operations of Cummins Incorporated Charleston Management Services Laboratory (CMS Lab) in North Charleston, SC. The operation was slated to be closed during the summer as a cost reduction. However, when Cummins discovered that the manufacturing operations would suffer due to the loss of the lab, the CMS Lab was put up for sale. Jeff Brodt, Site Manager for Cummins, Inc. said "All of the bids were nominally the same from a financial standpoint. However, IMR had the overwhelming support of the labs' employees so we chose IMR because they seemed sincere in their intent to retain the labs' employees who are well respected by Cummins staff here in Charleston."



True to our intent and promises, that is exactly what we did. We already had a good working relationship with the CMS lab employees. CMS was an established customer of ours, which enabled a smooth transition.

The CMS lab is quite impressive, as would be expected in a world-class company. There is a full complement of metallurgical capabilities, including a Cambridge SEM with EDS, tensile testing equipment, hardness testers, chemical analysis equipment, and a state-of-the-art gauge lab with a CMM, height gauges, surface plates and everything needed for dimensional inspection and layout. The lab is also A2LA accredited to ISO/IEC 17025.

Melissa Gainey serves as Lab and Quality Manager, Charlie White runs the gauge lab, and Wil Barwick is the staff chemist and assists in the met lab. This core group of former Cummins employees cumulatively have over 45 years of experience with Cummins and its sister companies. Their email addresses are: mgainey@imrcharleston.com, wbarwick@imrcharleston.com and cwhite@imrcharleston.com.

Ted Turanski, who you may remember as a metallurgist here in Ithaca, has accepted the position of Chief Metallurgist and has relocated to Charleston. His email address is turanski@imrcharleston.com.

The Charleston lab has many similar testing capabilities as IMR (New York). It does offer some services that are not available here, most notably the gauge lab services and X-ray diffraction.

We encourage you to directly contact the Charleston facility to learn more about their capabilities.

The main number is 1-843-740-2901.

IMR IS ACCREDITED BY A2LA TO ISO/IEC 17025:1999

Deena Crossmore, Quality Manager



Every 2 years IMR is audited by A2LA. In the past, the standard that we were audited to was ISO Guide 25. That standard has been replaced by ISO/IEC 17025, which now includes many of the elements that are in ISO 9000 and is universally accepted in the world. During the last week in February, A2LA audited us to the new specification and we passed without a problem. If you need a copy of our scopes of accreditation, see our website at www.imrtest.com or contact Deena Crossmore, deena@imrtest.com.

IMR Receives Sikorsky Accreditation

IMR Test Labs was certified by Sikorsky Helicopters in December of 2001. Stratford, CT based Sikorsky (maker of the Comanche attack helicopter) certified IMR in the fields of metallurgy, failure analysis, mechanical testing and chemical analysis of a wide range of materials used in their aircraft. In addition, in February, five employees were approved as flight safety inspectors for Sikorsky parts. IMR can pre-test flight safety critical components used on aircraft.

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Microscopic SEM and FTIR Failure Analysis

Terri Cheatham, Chemist, Non-Metallics Department



Contaminants are frequently related to functional or cosmetic product failure. In most cases, identification of the contaminant is instrumental in determining the root cause for the failure. Unfortunately, most contaminants are present in small amounts or in very thin layers making analysis by conventional macroscopic techniques difficult, if not impossible, to perform.

Scanning electron microscopy (SEM) and microscopic Fourier transform infrared (microFTIR) spectroscopy are two methods employed for material identification of these small samples. IMR's scanning electron microscope is equipped with an energy dispersive spectrometer (EDS) to allow for the detection and semi-quantitative analysis of elements with atomic numbers greater than boron. This technique is used to identify the elements present in a sample but cannot determine the chemical structure of the material. For example, most polymers, which commonly contain carbon, hydrogen and oxygen atoms, will exhibit similar SEM/EDS spectra. Therefore, differentiation between most organic and several inorganic species is best accomplished by another analytical method.

FTIR spectroscopy is used to measure the infrared absorption frequencies of chemical functional groups in a substance and when compared to spectral libraries can identify materials that absorb infrared energy. It is an especially powerful tool for polymer identification. A microscope attachment permits microanalyses of specimens as small as 70µm (roughly the diameter of a hair strand).

The following case study of intermittently operating electrical switches is an example of the combined capabilities of SEM/EDS and microFTIR. The failed switches had been stored in a humid warehouse environment where they experienced excessive heat in the day and temperatures below the dewpoint at night.

A microscopic examination revealed the presence of white powdery debris on the contact bridge and poles of the switches. A white residue also coated the zinc contact springs and in some areas appeared to have formed a three-dimensional drop-like structure suggesting formation associated with a water droplet.

SEM/EDS spectra of the white powdery substance on the contact bridge and poles of the failed switches identified the elements zinc, carbon and oxygen. A similar spectrum was obtained for the residue on the springs. MicroFTIR analysis revealed that the contaminant is a form of zinc carbonate, probably zinc carbonate hydroxide, and appears to be a corrosion product of the zinc plating on the springs. Typically, zinc reacts with atmospheric oxygen to form a thin zinc oxide or hydroxide protective layer. This material then reacts with atmospheric carbon dioxide to form zinc carbonate. Portions of the springs exhibited this thin layer. However, if stored in a humid environment where the temperature drops below the dewpoint, large condensation droplets may form on the metal surface. Reaction of the oxygen in the water with fresh zinc will produce bulky deposits of porous zinc oxide, especially along the outer edges of the drops where the oxygen concentration is greatest. After conversion of the oxide to carbonate, the zinc plating contains thick deposits of the corrosion product commonly referred to as wet storage staining, as is the case for the residue on the contact springs. It was surmised that with use, the up and down movement of the spring dislodged portions of this residue thereby allowing particles to fall intermittently on the bridge and poles.

Employee News

- **Ron Parrington** gave a presentation in April 2002 to the Bar Association of Eric County titled "Product Liability and Failure Analysis."
- **Tim McGrady** is presenting a paper at the 2002 World Congress on Powder Metallurgy & Particulate Materials Exhibition, June 2002.
- **Neil Burns** gave a lecture in April 2002 on Metallographic Preparation as part of the Metallography and Microstructural Analysis Course at The Center of Innovative Sintered Products (CISP) at Pennsylvania State University, PA.
- On April 15th and 16th, **Ron Parrington** taught a new course entitled "Nonmetallics for the Metallurgist" at ASM headquarters in Materials Park, Ohio. This original course created by Ron was well received and will be taught again in October at Cerritos College (Norwalk, CA).

Employee News, continued

- Spring 2002, **Ron Parrington** is teaching a five week course titled "Principles of Failure Analysis".
- **Tim McGrady** has developed a course for ASM titled "Basic Chemical Analysis of Metals" designed for the non-chemist. If you are interested, please contact Tim at (888) 464-8422.
- **Dave Christie** attended a Metal Powder Industries Federation course on Failure Analysis of Powder Metals in October 2001.
- **Ed Brothers** attended a conference titled "The 27th International Symposium for Testing and Failure Analysis," sponsored by the Electronic Device Failure Analysis Society which is an affiliate society of ASM International.
- Mechanical and Metallurgical Departments were trained on current practices for thermal spray coating analysis by Art Geary and John Sauer.
- **Deena Crossmore** attended a 2-day course offered by A2LA on calculating measurement uncertainty.
- **Terri Cheatham** completed an Intermediate Rubber Technology course presented by the Rubber Division of the American Chemical Society.

New Equipment at IMR

IMR has recently upgraded our analytical capabilities with the purchase of a **gas chromatograph equipped with a mass selective detector (GC/MS)**, headspace analyzer, pyroprobe and autosampler. The acquisition of this instrument allows for the qualitative and/or quantitative analysis of many organic compounds and gases.



Other new acquisitions include:

- Ion Chromatography – Metrohm Model # 761
- Helium Pycnometer
- Microtrac S3000 Particle Size Analyzer
- CEM MDS 2000 Microwave Digestor
- Buehler Isomet 4000 Linear Precision Metallographic Saw
- Carbon Coater for SEM Analysis
- CAD System

- EDM
- High Speed Data Acquisition Software
- Instron Model 5584 30K Tensile Testing System
- Hardness Tester – New Age Indentron Model
- Optical Comparator
- Pin-on-Disk and Reciprocating Wear Tester
- 12" Struer Autopolisher

New Employees at IMR

● Bill DeLaurier, Polymer Specialist, Supervisor, Non-Metallics Lab

Bill holds a BS in Chemical Engineering from Clarkson and an MS in Engineering Management from Syracuse. He has 7 years experience running the non-metallics lab for Carrier Corp.

● Paul Eastman, Machinist

Paul comes to IMR with 15 years of machinist experience. He is an expert in fabricating metals and plastics.

● Kevin Geiger, Machinist

Kevin has over 15 years of CNC machining experience working in the aerospace and automotive industry.

● Deb Gutches, Accounting

Deb holds an AAS in Accounting. She has over 20 years of supervisory experience and in the past five years has been an independent contractor to several local, small businesses.

● Sue Laratta, Administrative Assistant, Chemistry Department

Sue holds a BS in Psychology from Ithaca College and an AS in Liberal Arts from Tompkins Cortland Community College.

● Redcliff Magill, Metallurgical Technician

Red received his metallurgical training while serving our country in the United States Navy where he was consistently evaluated as a "Top Performer" and was called upon to set professional standards for others to follow.

● Rob Presthus, Metallurgical Technician

Rob holds a BS and MS in Physics from SUNY Binghamton and an AS in Engineering Science from Tompkins Cortland Community College. He has over 12 years laboratory experience.

● Jody Russell, Mechanical Test Specialist

Jody received his mechanical training while serving in the United States Army. He specializes in electronics with a broad base of knowledge in vibration and strain gage testing.



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**Analytical Variety at
IMR**

Listed below is a small sampling of testing performed this year at IMR:

- Comparison of multilevel circuit boards for ship application (previous supplier vs. current supplier)
- Cyclic testing of switches to 10 million cycles (R.T. and at - 40°F)
- Medical device polymer identification
- EDS analysis of aluminide diffusion coatings on aerospace components
- Medical implant 3 point bend testing
- 680°F, 168 hour stress relaxation tests
- Failure analysis of children's plastic toy
- Halide analysis to parts per billion level
- Braze analysis (peel, microstructure, chemistry)
- Methods development for chemical testing of processes for various companies
- Performance testing of labels (adhesion, UV, cold cracking, corrosion)
- Testing of stadium seat for 1000 hours in salt fog (ASTM B117)
- Machining of specialized fixtures and test setups for customers
- Charpy impact machining and testing of aerospace drive shaft
- Image analysis of porosity in automotive castings and thermal spray coatings
- Bond pull tests of thermal spray coatings
- Aerospace EDM and aggressive machining checks
- Turbine blade cutup and analysis
- XRF coating thickness measurements

IMR Trivia Question:

**Why are Mercury Thermometers Prohibited
on Aircraft by the Federal Aviation
Association?**

contact Jeff Zerilli with the answer.
email: jeff@imrtest.com

The best five answers will receive an IMR denim shirt

**Mark your calendar:
5th Anniversary
IMR Open House
October 4th, 2002**