Newsletter of the Atlanta Chapter of ASM International
http://www.asm-atlanta.org/ Normally Meets 3rd Tuesday
November, 2005 Volume 12 Number 3

November Meeting of the Atlanta Chapter of ASM

Tuesday Evening, Nov. 15, 2005
In the Georgia Tech School of Materials Science & Engineering
Located in the Love Building - 3rd Floor Atrium

"Electromagnetic Shielding & Corrosion Prevention Methods for Aircraft"

presented by

Jan W. Gooch & John K. Daher
Adjunct Professor & Principal Research Engineer, respectively
Georgia Institute of Technology

also

"Quantification of Arterial Plaque Microstructure for Development of Finite Element Models"

presented by

Melissa Hallow
A 10-minute student presentation
School of Materials Science & Engineering,
Georgia Institute of Technology

Tuesday Evening, November 15, 2005

Wine Reception & Social: **6:00 PM**
Dinner: **6:30 PM**
Introductions & Business: **7:15 PM**
Melissa Hallow's Presentation: **7:30** PM
Dr. Gooch's Presentation: **7:45 PM**
Meeting adjourns by **9:00 PM**
Dinner Costs:
$**20.00** for Professionals, $**6.00** for Students

WHERE -- The GA Tech School of Materials Science & Engineering, in the J. Erskine Love Manufacturing Building.

Map: http://www.asm-atlanta.org/

Menu: Bistecca Style Grilled New York Strip served with potato daphunoise and topped with red wine compound butter, classical caesar salad, fresh seasonal vegetables, dinner rolls w/creamy butter, iced tea, coffee, ice water, dessert bars

Reservations: RSVP - by Monday, November 15 to **Marlene White**,
Tel: (404) 894-2850, Fax: (404) 294-9140, marlene.white@mse.gatech.edu

Note: If it is necessary for you to eat elsewhere, please know that you are very welcome for the program. Come & meet with your technical friends and make new ones.

ABSTRACT:
ELECTROMAGNETIC SHIELDING AND CORROSION PREVENTION METHODS FOR AIRCRAFT

Dr. Jan W. Gooch; Adjunct Professor, School of Chemical and Bimolecular Engineering

Mr. John K. Daher; Principal Research Engineer, Georgia Tech Research Institute

The new generation of civil aircraft depends heavily on electronic systems to implement safety-critical functions. Because these aircraft may be exposed to high intensity radiated fields (HIRF) created by radio frequency (RF) emitters based on the ground, in the air, and at sea, civil aviation authorities have become increasingly concerned about the potential for electromagnetic interference (EMI) to these critical electronic systems. With the increasing density of the electromagnetic environment, civilian aircraft authorities and standards committees have developed HIRF requirements that are being applied to civil aircraft certification programs.

Military aircraft and weapon systems must operate compatibly within an electromagnetic environment that can be even more severe than the civil HIRF environment. For example, the electric fields from a high altitude, nuclear electromagnetic pulse (EMP) can reach peak amplitude of 50,000 V/m. Emerging high power microwave (HPM) threats can generate power densities in excess of 100 W/cm^2 at tactical ranges. And aircraft that must take off from and land on naval ships can be exposed to a dense and highly intense electromagnetic environment with electric field strengths exceeding 1000 V/m.

Military and commercial aircraft are assembled with many fasteners such as screws and bolts to secure airframes, skin and other bonded joints. The joints must be conductive or shielding effectiveness will not

be optimized. Conductive and corrosion resistant materials such as sealants and gaskets are required to maintain conductivity along the entire structure of the aircraft under flight and ground environmental conditions including moisture, rain, and pollution from the atmosphere. The conductivity of corrosion resistant sealant materials must be monitored under accelerated weathering conditions to determine the conductivity over an extrapolated period of time to simulate an acceptable life of the sealant between scheduled maintenance periods. Comprehensive studies that provided understanding of shielding effectiveness, as related to conductivity, and the relationship of material chemistry to conductivity and corrosion were performed to provide fundamental understanding of these phenomena, and finally, optimized shielding effectiveness for aircraft.

Significant progress was made in the identification and, ultimately, optimization of corrosion prevention materials and/or processes. These materials are capable of protecting metal surfaces from air/moisture corrosion over a specified period of time. In addition, electrically conductive corrosion prevention materials that are capable of maintaining EMI/EMP protection of aircraft and weapon systems were identified. With these capabilities, existing aircraft and weapon systems can now be protected from further corrosion, and existing nuclear-hardened weapon systems can be retrofitted with corrosion prevention. From these efforts, American Materials Standard, AMS 3262, was prepared for the user of conductive silicone rubber-based sealant.

Jan W. Gooch, Ph.D. 2001-2004: At the US Army Institute of Surgical Research, Dr. Gooch developed: Liquid and powder dressings for wounds using emulsions and basic polymer science and engineering expertise; photo-polymerizable tissue and blood vessel adhesives; and automatic tourniquets for wear in a combat uniform providing the solider with self-tourniqueting capability of upper- and lower-limbs. 1983-2001: At Georgia Tech, Dr. Gooch founded and managed the Polymer & Coatings Program within the Electro-Optics, Environmental & Materials Laboratory, conducted research and development in fundamental and applied polymer science and coatings technology. 1981-1982: With Cook Paint & Varnish, performed and supervised research and development of resins for industrial coatings and fiberglass composites including synthesis, pilot plant, production, and testing phases. 1979-1981: At Bechtel Group, Inc., Dr. Gooch provided technical services internationally in areas of industrial coatings, polymers, composite materials corrosion prevention methods. 1976-1979: At the University of Southern Mississippi conducted graduate research involving polymer synthesis, characterization, kinetics studies, viscometry and coating formulations. 1973-1976: As Technical Director with Wrape Enterprises, performed research and development in industrial air and water pollution control systems including pilot and prototype designs. Dr. Gooch is presently conducting research in biomedical materials including dressings for wounds, broad spectrum antimicrobial and biocompatible emulsions, and lightweight automatic tourniquets for casualty-care programs. Electromagnetic shielding; electroactive polymers; thin film liquid crystal displays; plasma polymerization, metal and other vapor deposition/sputtering; manufacture and testing of plastic containers including PET bottles; polymer-solvent intermolecular reactions; design and testing of plastic and composite materials; low volatile organic content (VOC) coatings including flameless and plasma spray, water-borne and high solids coatings for corrosion protection of metal substrates in chemical aggressive atmospheres; injection molding of polymer parts; dispersion technology for generating polymer/solid and polymer/polymer systems.

John K. Daher 1998 – Present: At Georgia Tech has been the principal investigator and a major contributor to numerous research projects in the areas of high power microwave/ultra-wideband/electromagnetic pulse (HPM/UWB/EMP) effects, electromagnetic hardening, electromagnetic susceptibility/ vulnerability/ lethality (EMS/V/L), and EMI/EMC. Mr. Daher has provided HPM design, modeling, analysis, and test support to Air Force, Army, and Navy sponsors**.** 1976 – 1998**:** He has performed electromagnetic coupling measurements on helicopters and an avionics bay mockup for a commercial helicopter manufacturer in support of the High Intensity Radiated Field (HIRF) certification

process. Mr. Daher has performed HPM and UWB susceptibility/vulnerability analyses of selected foreign systems as a member of the DDR&E Foreign Asset Assessment Team (FAAT). Mr. Daher has also provided GPS jamming analysis and test support to SAF/AQLR as a member of the GPS Counter-PGM Red Team. Designed and implemented a fiber-optic diagnostic system for non-perturbing measurement and recording of system internal fields and voltages. Has performed HPM/UWB susceptibility analyses of US systems including the F-22, low altitude navigation targeting infrared for night (LANTIRN), theatre missile defense - ground based radar (TMD-GBR), conventional air-launched cruise missile (CALCM), GBU-24/27, AGM-130, and improved data link (IDL). Mr. Daher was a member of the Review Team for the handbook "High Power Microwave Hardening Design Guide for Systems" prepared for Harry Diamond Laboratories. Has designed miniature EM field sensors for aircraft applications and wideband antennas for UWB applications. Principal investigator on programs on which the EM susceptibility of photonic devices were assessed; a test methodology was developed and successfully demonstrated to exploit the built-in-test capability of advanced VLSI/VHSIC devices and PC boards to simplify RF susceptibility measurements; the shielding effectiveness of cable shields was assessed at cryogenic temperatures; an EM susceptibility test methodology was developed for VLSI/VHSIC devices and successfully demonstrated; two programs on which the shielding effectiveness of ribbon cable shields were assessed; EMI filters were designed to enable a Navy computer system to meet MIL-STD-461 CE01/CE03 emission limits; and conductive sealants were successfully developed and evaluated: (1) in the laboratory as a function of exposure time in a salt-fog chamber environment and (2) in the field on E-3 and F-18 aircraft. Mr. Daher was a major contributor in the design of a wideband receiver for a millimeter wave near field antenna range; the design, fabrication, and evaluation of two RF data link antennas for the PATRIOT system; the development of circuit-level HEMP hardening techniques; conducted emission measurements on the TOMAHAWK Vertical Launch System; the design of digital data communications equipment; development of new EMI measurement techniques for spread spectrum systems; measurement and analytical modeling of intermodulation generation in passive components; and the evaluation of HEMP protection measures for defense electronics installations.

Abstract for Student Presentation: "Quantification of Arterial Plaque Microstructure for Development of Finite Element Models" By **Melissa Hallow**

The rupture of arterial plaque, leading to heart attack and stroke, is the leading cause of the death in the United States. Finite element models are important tools in studying the factors contributing to plaque rupture. Accurate representation of plaque microstructure is required in order to develop meaningful finite element models. However, quantification of the microstructure of plaque is problematic, since plaques are extremely heterogeneous. Atherosclerotic plaques are comprised of four important structural constituents: healthy tissue, fibrous deposits, lipid deposits, and calcium deposits. Most current finite element models divide plaque into regions of these four constituents, but assume homogeneity within each constituent region. However, in real plaques, there are not typically clearly defined regions of constituents, but instead each constituent region fades into the next, with a varying degree of constituent mixing in the transition region, and even with some degree of mixing within the constituent region. Our lab is currently attempting to use a mixture theory based on area fractions of each constituent. However, this method still does not account for directional effects such as collagen fiber alignment. Further improvements are needed for a more meaningful mechanical model of plaque.

The Atlanta Chapter of ASM International is pleased to announce…
ASM Materials Education Institute (MEI)

Corrosion

2-Day Short Course

DATES: December 1st and 2nd, 2005

LOCATION: IPST Building
Georgia Institute of Technology
500, 10th Street, NW
Atlanta, Georgia

The course will be presented by several members of the Atlanta Chapter of ASM International, and be co-instructed with local industry experts. The course will utilize the MEI course materials developed by ASM International, and each student will be provided a notebook including all course materials, and self tests. A final exam will be administered for those seeking credits.

ACCREDITATION
Corrosion short course qualifies for 2.0 CEU Credits.

WHO SHOULD ENROLL
Engineers, managers, metallurgists and technicians who are responsible for recognizing the cause of corrosion and combating or minimizing corrosion will gain considerable knowledge. They will also be able to expand their expertise in cost reduction by becoming knowledgeable about proper materials selection and use in harsh environments.

HOW TO ENROLL & COST

SEND YOUR COMPLETED FORMS TO MARLENE WHITE BY NOVEMBER 21, 2005,
Georgia Institute of Technology, J. Erskine Love, Jr. Manufacturing Building, Room 299, 771 Ferst Drive, Atlanta, Georgia

For Further Information Contact: **Marlene White**, Tel: (404) 894-2850,
Marlene.white@mse.gatech.edu
Or **Preet M. Singh**, Tel: (404) 894 6641 Preet.Singh@mse.gatech.edu

COST: ASM MEMBERS $295; NON-MEMBERS $345

BASIC OVERALL CONTENT
This course will cover fundamental principles of corrosion, helping participants recognize corrosion problems, determine their causes, and then select control methods. Emphasis will be given on the practical applications of corrosion technology to solve industrial corrosion problems.

WHAT YOU'LL LEARN:
- Recognize and define corrosion problems
- Understand how to develop and implement corrosion control programs
- Corrosion test methods and interpretation of results

COURSE CONTENT:

1. Basic Concepts in Corrosion -- definitions; costs associated with corrosion; immune and passive corrosion behavior; how corrosion is affected by a metal's metallurgy, inherent reactivity, and tendency to form insoluble corrosion products; how a solution's characteristics affect corrosion; how to protect metal from a corrosive environment

2. Thermodynamics: Potential - pH Diagrams -- changes in a metal's equilibrium with its environment; the Nernst equation; the electromotive force series; potential - pH (Pourbaix) diagrams, how they're used and what they can tell us; three states of passivity; several real-world applications illustrating examples of these concepts

3. Kinetics of Corrosion: Polarization -- kinetics of the corrosion reaction; electrochemical reactions; important anodic and cathodic reactions; mixed potential theory; some applications of mixed potential theory

4. Different Forms of Corrosion: Details of mechanisms;recognizing features, how to control each form of corrosion
Uniform Corrosion
Pitting Corrosion
Concentration Cell
Galvanic Corrosion
Stress Corrosion Cracking
Hydrogen Embrittlement
Erosion-Corrosion,
Intergranular Corrosion and Dealloying

5. Corrosion Testing and Monitoring -- classification, purposes, and steps in conducting corrosion tests; surface preparation; standards; practices; planned interval tests; accelerated testing; monitoring; direct and indirect measurements; numerous real-world examples

6. Electrochemical Test Methods -- general classes of electrochemical measurements; potential current, resistivity, polarization curves, linear polarization, frequency response; methods and equipment for these measurements; galvanic

7. Methods of Control - Coatings and Potential Modification -- anodic and cathodic protection systems; impressed-current protection; measuring and verifying protection; barrier, inhibitive, and sacrificial coatings; organic, inorganic, and metallic coatings; desirable coating features; elements of the coating process, curing mechanisms; Design, Material Selection, Environment Modification-- design methods and materials selection to control corrosion; changing environment to control, and application of inhibitors.

ASM Materials Camp

Materials Camp is an outstanding opportunity for high school students to experience quality exposure to advanced instrumentation and methods of materials analysis. And it is essentially **FREE** to the student. We have been able to place a student from the Atlanta area in these camps each year - **except for last year - when no one even applied from our area**!! We were asked by camp personnel "what happened" while at metals Park during the camp in August. Let's not have this opportunity pass us again this year. **One resident camp will be in Cleveland, OH, August 7-13 and another July 23-28 in the dorms at**

the University of Missouri-Rolla. For information, please contact the Atlanta Chapter's Education & Academic Advisor, Professor **Naresh Thadhani** at naresh.thadhani@mse.gatech.edu or 404-894-2651. Get in touch with Dr. Thadhani as soon as possible to learn what is required for the application and begin to process paper work before the year ends so that at least one bright young person from the Atlanta area, or Georgia, can take advantage of this truly outstanding opportunity.

This weeklong academic camp features highly interactive, lab-based activity tailored to individual student interest areas. Evening social activities include a materials "sub-theme" (i.e.; tours of local attractions and industry tours, etc.). Students "graduate" during a special event with chapter, ASM, and Foundation leaders, where they have the opportunity to meet and network, and explore career options.

Materials Camp begins with a welcome reception and dinner, where students, faculty and staff get acquainted. Second day opened with an introduction to materials of today and tomorrow, along with a basic overview of materials failures and why/how they occur. The students are then organized into small groups and teamed with a Volunteer Faculty "Materials Mentor" who works with them throughout the week. A variety of experiments and lab activities such as metallography, mechanical testing, light microscopy, fractography, scanning electron microscopy, image analysis, and chemical analysis are used.

The camp concludes with the teams presenting a summary of their findings, including recommended corrective action to members of the ASM Foundation Board, ASM International Board, the entire Materials Mentor Faculty, and their student peers. The program ends with graduation and a dinner.

Target Audience
Students entering their **junior** or **senior** year in high school.
Highly motivated inquisitive learners with math and science aptitude.

Cost
Students receive free housing, meals, tuition, entertainment and knowledge.

Application deadline at ASM HQ is January 31.

Required information includes school transcript, a maximum of two letters of recommendation
Personal essay (100 words or more)

Selection Of Finalists
This is a competitive application process. Students must have basic knowledge of algebra, chemistry, and physics and describe why they want to learn more about engineering and materials science as a possible college major and career.
Experienced practicing engineers review each application to select the "best and brightest," highly motivated students who have not yet made a firm decision about a college major or career.

Students must have a strong interest in applied science. Prior participation in science fairs is helpful, but not required.

2005-2006 Yearbook

Dr. John Mihelich has developed the 2005-2006 Chapter Yearbook. The official ASM Members of the Atlanta Chapter should have received an electronic copy of this document in June. If a chapter member

was somehow missed and wishes to receive a free-of-charge copy, please send your email address to John. Hard copies are also available for $10 each.

If a company or an individual wishes to advertise, space will be available. A business card size ad is going for $25 and a **half page** for $50. Copy must be email publication ready to be accepted. Time is short so please send your ad to <mailto:jlmihelich@comcast.net>jlmihelich@comcast.net as soon as possible.

Employment Position Available:

SALES REP: Part time, 3-4 days per week. Manufacturer's representative of custom mechanical components seeks individual to call on manufacturing accounts in GA. Excellent for professional or engineer with knowledge of various mechanical processes. Steady opportunity. Base + expenses. Send work experience to: President, PO Box 83, Fairport, NY 14450.

Officers for the 2005-2006 Chapter Year

The ASM Atlanta Chapter officers for the 2005-06 year:

Chairman:	**Hamid Garmestani**	hamid.garmestani@mse.gatech.edu
1st Vice President (Programs):	**Gautam Patel**	gautam.patel@gtri.gatech.edu
2nd Vice President (Industrial Relations):	**Harry Tian**	htian@giwindustries.com
Treasurer:	**David Morrison**	davidmorrison@stcmetals.com
Secretary:	**John Barnes**	john.e.barnes@lmco.com

The Chapter 's Executive Committee consists of the above five Chapter Officers plus the following Standing Committee Chairs

Membership	**James Lane**	JLANE@mactec.com
Education & Academic Advisor:	**Naresh Thadhani**	naresh.thadhani@mse.gatech.edu
Yearbook/Directory:	**John Mihelich**	jlmihelich@comcast.net
Finance:	**George Kremer, Past Chair**	gwkremer@bellsouth.net
Newsletter Editor:	**Bill Livesay**	livesay3@bellsouth.net
Web Site Coordinator:	**Jud Ready**	jud.ready@gtri.gatech.edu
Short Course Director:	**Preet Singh**	preet.singh@mse.gatech.edu
Ga Tech Student Chapter Chair:	**Simon Dunham**	gtg949d@mail.gatech.edu
Council of Past Chairs:	**Steve Johnson**	steve.johnson@mse.gatech.edu
	Kim Spinsby	kim.spinsby@siemens.com
	Jim Hubbard	jhubbard@magianalysis.com

The chapter leadership is always looking for chapter members who are interested in actively supporting the work of your chapter. This is a particularly good time of the chapter year to contact one of the recently elected officers and offering your services as a member of one of the standing committees listed above. Please, please step up and contact one of these individuals!! You will find working with a technical society, and particularly this one, to be a rewarding experience.

Features of ASM-Atlanta

The Newsletter of the Atlanta Chapter of ASM International

- Program Notes for Meetings
- Chairperson's note to members.

- Career Development: job opportunities or jobs needed
- Company Feature:
- Technical Features:
- Education Feature: Materials course offerings.
- Georgia Tech Student Chapter News
- Member News
  - Special Events, Awards & Honors.
  - New Members
  - Deaths
  - Transitions
- ASM International News
- Advertisements
- Outreach (ASM members to Schools, Scouts, etc.)

Send information, articles or suggestions to:

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