Letter from the Chair
Welcome to the newsletter of the Failure Analysis and Prevention Special Interest Group (FAPSIG) of the Society of Plastics Engineers. Inside you will find an overview of the ANTEC 2010 conference, a call for papers for the 2011 ANTEC conference, new hires in the industry, naming of the FAPSIG best paper award, an article on melt flow rate, and a little history on Leo Baekeland. I hope you find these articles informative and useful. I encourage you to give feedback or possibly contribute a small article or press release for the next FAPSIG newsletter.

The FAPSIG has a mission statement, which reads:

SPE Failure Analysis & Prevention Special Interest Group is a forum for discussing all aspects of polymer failures, including root cause analyses, identifying and understanding failure mechanisms, predictability, and mitigation/preventative measures.

One of my goals is making this newsletter an integral part of the FAPSIG. Michael Hayes of Engineering Systems Inc. is putting together another opportunity to communicate with the creation of a FAPSIG LinkedIn account. This social network gives all members the ability to pose questions or offer information to others in the industry, with the ability to get almost immediate feedback. The ANTEC conference has been the traditional forum for the FAPSIG and will continue to be the primary means of education and networking for the plastics failure community. If you feel you have some knowledge that will benefit the failure analysis community I encourage you to present a paper at this conference.

I hope to see you in Boston this coming May.

Paul J. Gramann, Ph.D.
The Madison Group
Chair – Failure Analysis and Prevention SIG
FAPSIG 2011 ANTEC Call For Papers
Deadline November 19, 2010
The Society of Plastics Engineers will hold its annual technical conference from May 1-5 in Boston, MA. There is no other educational opportunity compared to this event. There literally is something for everyone involved with plastics. The FAPSIG has issued a call for papers related to, but not limited to:

- New Failure Analysis Techniques
- Prevention Methods
- Case Studies
- Material Behavior
- Cause/Mode of Failure
- Failure of Specific Materials

Contact the FAPSIG Technical Program Chair Dale Edwards at dbedwards@esi-il.com if you have any questions. Papers are due November 19, 2010.

Prof. Chudnovsky Receives Best Paper Award
The Failure Analysis and Special Interest Group (FAPSIG) paper review committee selected “Temperature Effects on Slow Crack Growth in Pipe Grade PE,” by Zhenwen Zhou, Haiying Zhang, and Alexander Chudnovsky of the University of Illinois at Chicago and W. Michie and M. Demirors, The DOW Chemical Company for the best paper submitted to the FAPSIG for ANTEC 2010. The runner-up papers for this award were:

- “Failure Analysis of Hinged Housing Assemblies,” By Jeff Jansen

The abstract of the best paper was:

Temperature strongly affects the mechanical properties of pipe grade polyethylene (PGPE), such as strength and toughness. It is observed in this study that the temperature also affects the mechanisms of slow crack growth (SCG). A change in the mechanism of SCG is observed at certain temperature, named Crack Growth Transition Temperature (CGTT). The CGTT of the cold drawn (oriented) PGPE appears to be significantly higher than room temperature. At the temperature above CGTT the crack propagates discontinuously, stepwise, whereas at the temperature below CGTT the crack grows continuously. The slope of crack growth rate vs. stress intensity factor (SIF) is also noticeably different for temperatures above and below CGTT. The existence of CGTT implies certain limitations for commonly used extrapolation of SCG and life time data from the elevate temperature of an accelerated testing to the room temperature across CGTT.
Testing Methods by Jeff Jansen

Melt flow rate (MFR) is a useful analytical technique that can provide information as part of a failure investigation or material characterization. MFR is a means to indirectly assess the molecular weight of a material, and is thus useful to determine if molecular degradation has occurred or if the correct grade of resin has been used.

MFR testing is performed in a relatively straightforward piece of equipment that is commercially available from a number of vendors. The testing parallels the injection molding process. It involves heating a quantity of the material in a heated barrel and then extruding the material through a standardized orifice. The amount of material that extrudes in a set period of time is weighed, and the results are normalized to the units g per 10 min. The testing is covered by ASTM D 1238 and ISO 1133. A common variant is to determine the melt volume rate, which is simply the volume of material that is extruded in a 10 minute period.

MFR is inversely proportional to the melt viscosity, and melt viscosity is relational to the molecular weight. Thus, a reduction in molecular weight will translate to reduced melt viscosity, and a lower melt viscosity will produce a higher melt flow rate. Melt flow rate is not a direct measurement of the molecular weight of a polymer, as is gel permeation chromatography (GPC), but has the advantage that MFR is commonly performed by resin suppliers and baseline data is readily available. In fact, melt flow rate is used to differentiate the various grades of a material type available from a supplier.

As part of a failure investigation, the MFR of the failed part is often compared to that of the resin used to produce the part. By comparing the difference in the MFR values it is possible to ascertain whether the molded part has undergone molecular degradation, either from the molding process or for field service. Lacking a sample of the lot of resin used to produce the parts in question, a typical lot sample is a fallback. Absent any molding resin, the values obtained on the failed parts can be compared to the published data from the resin supplier.

While relatively simple, melt flow rate testing can provide valuable insight into the cause of a plastic failure. – Jeff Jansen, The Madison Group
Jeff Jansen Joins The Madison Group

The Madison Group is pleased to announce the addition of Jeffrey A. Jansen, M.S. Mr. Jansen has over 22 years experience in polymer science, including plastics, composites, and rubber compounds. He established and managed a polymeric materials testing and engineering laboratory, specializing in analytical and mechanical evaluations. Jeff specializes in polymeric failure analysis, material identification and selection, and aging studies for thermoplastic and thermoset materials. He has performed over 900 failure investigations, both for industrial clients and litigation work. Jeff is a graduate of Carroll College and the Milwaukee School of Engineering.

“Jeff is well-known in the plastics community and brings years of experience to our growing staff of plastic professionals,” states Bruce Davis, CEO, The Madison Group.

Mr. Jansen is an active member of several professional organizations. He has authored numerous publications, and has also taught a wide range of seminars for The Society of Plastics Engineers (SPE) and other associations. He can be reached at 608-231-1907 or via email, jeff@madisongroup.com.

Anan “Andy” Shaw Joins Engineering Systems, Inc.

Engineering Systems Inc. (ESI) is pleased to announce the addition of Anand (Andy) R. Shah, M.S., M.B.A., P.E., Senior Consultant, to the company’s Chicago (Aurora), IL office staff. Mr. Shah has over 12 years experience in materials engineering, including work on plastic pipe, underground storage tanks, automotive and plumbing parts, medical devices, power tools, wood-plastic composites, and other consumer products. He is also a licensed Professional Engineer in the state of Illinois.

Mr. Shah specializes in polymer failure analysis, material characterization, material selection, and product design and development. His expertise includes plastic failure analysis, product design evaluation, characterization of polymers, elastomers, and polymer composites, polymer failure mechanisms, and structure property relationship in polymeric material. He utilizes principles of structure property relationship to provide solutions to product performance and service life issues. He established and supported growth of a long-term mechanical property testing laboratory through promoting creep, stress-rupture, and stress-relaxation testing.

“We’re extremely pleased to have Andy join our staff,” states Dale Alexander, ESI Principal. “His expertise will work well in several of our discipline and specialty areas and will greatly add to our growing technical staff.”

Mr. Shah is a member of several professional organizations, as well as having numerous publications and presentations. He can be reached at 630-851-4566 or by email at arshah@esi-il.com.

Gianna Strohm Joins The Madison Group

The Madison Group is pleased to announce the addition of Gianna S. Strohm, M.S. Project Engineer.

Ms. Strohm has had the opportunity to collaborate with Professor David Grewell from Iowa State University on his work with biodegradable plastics as well as control algorithms for ultrasonic welding. Her research background includes micro fabrication as well as the combination of nano-energetic materials and polymeric binders.

“We are very excited about Gianna joining The Madison Group. Her multidiscipline background will be extremely valuable to our failure analysis and engineering groups,” states Antoine Rios, Principal, The Madison Group.

Gianna is a graduate of Purdue University and the Ohio State University.

She can be reached at 608-231-1907 or via email, gianna@madisongroup.com.
FAPSIG Best Paper Award to be Named after Prof. Myer Ezrin.
The FAPSIG Board overwhelmingly approved Don Duvall’s motion to name the FAPSIG Best Paper Award after Prof. Myer Ezrin. The FAPSIG Best Paper award is given for papers submitted to ANTEC for the FAPSIG and is decided by a panel of reviewers. The winner of this award receives a plaque donated by sponsors of the FAPSIG at ANTEC. Professor (Emeritus) Ezrin has possibly given more papers at the ANTEC conference than any other author (no official statistics). At the past several ANTEC conferences Prof. Ezrin has given 3 – 4 presentations/seminars – at each conference. His jubilant and passionate method of giving presentations typically has standing room only. Prof. Myer has agreed to give a tutorial/seminar at the 2011 ANTEC titled “How Come Some Plastic Products Fail and Others Don’t?” As always, you will not want to miss this presentation – it will be worth the price of admission.

The Madison Group
Consultants for the Plastics Industry

Failure • Design • Processing Analysis

Failures cost money. Engineers at The Madison Group specialize in the analysis, determination of root cause, and prevention of plastic part failure. Using optical, analytical, and physical testing we ascertain contributing factors to failure, including design, processing, quality/type of plastic, and environment. Leverage our expertise to solve and prevent your plastic part failures.

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The Madison Group Is a proud sponsor of the SPE Failure Analysis and Prevention Group
6 History

History of Baekeland Selling to Eastman

Leo Baekeland is known for inventing the first synthetic polymer, called polyoxybenzylmethylenglycolanhydride or bakelite for short. Asked why he invented bakelite, Baekeland responded “to make money.” Prior to inventing bakelite, Baekeland invented a photographic paper that was much easier to develop than other products of the time. George Eastman of the Eastman Kodak company took notice of Baekeland’s paper and invited him to his office in Rochester, New York to discuss the sale of his invention. On the train ride to Eastman’s office, Baekeland decided that he would request $50,000 for the rights to his invention, but would sell it for $25,000 if Eastman wouldn’t accept. Shortly after his arrival, Eastman sat Baekeland down in his office to negotiate the sale. Before Baekeland could present his price of $50,000 Eastman stood up and stated “one million dollars should be a fair price, what do you say?” Baekeland went home richer than he ever imagined and used this money to fund his laboratory where he eventually invented Bakelite.

Paul Gramann, The Madison Group

Michael Hayes Creates LinkedIn Account For FAPSIG

Michael Hayes of Engineering Systems, Inc. (ESI) has created the official SPE Failure Analysis and Prevention LinkedIn account. Becoming a member allows you to stay more informed with the plastics failure community. This can be an excellent resource for you. For example, you will be able to ask other engineers in the plastics community question you might have on a particular failure or preventive measures that can be taken. To join go to your LinkedIn account (if you do not have an account go to www.linkedin.com to join for free) and search for the Failure Analysis & Special Interest Group.
Paul Gramann Gives Course in Saudi Arabia

In April of this year Paul Gramann from The Madison Group was invited to give a 3-day course on Failure Analysis and Prevention of Plastic and Rubber materials at King Saud University in Riyadh. The course was given at the Center of Excellence for Research in Engineering Materials (CEREM). He was received by Prof. Saeed M. Al-Zahrani, Ph.D. and was hosted by Prof. Rabeh Elithey (International Liaison for the FAPSIG). Prof. Elithey gave several sessions of the course with Paul. The course was very successful with attendees that included industry representatives, government agencies, faculty and Ph.D. students.

Prof. Myer Ezrin Gives Course in Malaysia

Prof. Ezrin recently gave a 2-day short course on Plastics Failure Analysis in Bangkok, Thailand, then in Kuala Lumpur, Malaysia. Each course consisted of 13 hours of lectures with questions and answers. The host was a commercial company, Technobiz Communications that organizes short courses and conferences in Asia. Sixy-two attendees in Bangkok and thirty in Kuala Lumpur attended Prof. Ezrin’s course.

“For me, it was a marvelous highlight near the end of my professional career (now 84).” Professor Myer Ezrin.
Minutes from FAPSIG ANTEC 2010 Meeting

May 17, 2010
Roll Call

Board Members:
- Paul Gramann - Chair
- Jeff Jansen - Past Chair, Sponsorship Chair
- Dale Edwards - TPC
- Jennifer Hoffman - Secretary
- Andy Shah – TPC (in training)
- Antoine Rios - Publicity Chair
- Javier Cruz - Education
- Mike Ezrin - Emeritus
- Don Duvall - Past Chair, Membership Committee Chair
- Dr. Rabeh Elleithy – International Liaison
- Tricia McKnight - SPE Manager, Leadership Services

Non-Board Members:
- Jan Spoormaker (Spoormaker Consultancy)- Eurotech 2011
- A. Chernovsky
- Joe Perez (Stork Technimet)
- Mike Hayes (ESI)
- Mike #2 (ESI)
- Keshor Mehta (Founding member of FAP SIG)
- Olivier Crave (SPE Europe Chair, Exec Committee liaison)
- Dr. Guido Tosello (Asst Prof in ME, Technical University of Denmark)
- Steve McLean (SABIC)

Introduction (Paul G.) – commended Andy Shaw on speaking on topic of ‘prevention’

Financial Status
- Treasurer report provided by Jackie Rehkof via email
- $432 budget
- Mike E- No income from SPE, only from sponsors for SIG
- Tricia (Liaison to leadership of SIGS)- allocation for funding on request

Naming of Best Paper Award (D. Duvall)
- Motion for “Myer Ezrin Best Paper Award”
- Seconded by A. Chernovsky
- Motion passed!

Membership discussion
- D. Duvall ~6,350 members
- Paul- When you sign up for ANTEC, there is no option to select SIG; need to select SIG in SPE profile online to get email blasts
- Jennifer- Why do we not charge to be a SIG member?
  - Keshor- no requirement. SPE may provide money/funding for certain activities. SIGs do not have responsibilities of division status.

ANTEC 2010
- Paul- Primary activity of FAP SIG is ANTEC
- Recent differences from prior years:
  - FAP SIG/ MPD joint session
  - FAP SIG/ Pipe & Fitting SIG joint session
  - Panel discussion
  - Tutorial session
- Talks well-attended
Sponsoring
- Jeff is sponsorship chair
- Need additional sponsorship chair
- Give sponsors press
  - Company logo on banner and on-screen between talks
- Keshor mentioned banner is difficult to see (Logos too low)
- $350/sponsor
- Incentives to get speakers are good
- Sponsors advertised
  - Newsletter (~6,350 recipients)
  - Inside of gift card cover
Gift Card v. Catering
- Starbucks gift cards- $5 each
- Catering costs are high (service fees)
- 125 cards given to those who stayed through morning session (asked to stay through afternoon)
- Andy- suggestion to give gift cards to those who ask questions
- Javier- give to those with good questions (that cause further discussion)

ANTEC 2011
- Next year’s BOD meeting- elect TPC
- TPC: a lot of work, including assigning reviewers, etc.
- Topical areas for consideration next year?
  - Non-traditional failures (non-fracture failures)
- Keshor- “failure” occurs if part does not fulfill function (does not have to be catastrophic)
  - Bioplastics
  - CSI effects (Jose volunteered to write paper)
  - Recalls (Mike, Don could talk on experiences)
- Panel session?
  - Need 1.5 hrs
  - In past, panel followed papers
  - Well-attended
  - Rabeh- make the session short
  - Who on panel? Who will moderate?
- Tutorial session- topics, case studies?
  - Main difference- no paper required
  - Interactive questioning
  - Don- likes idea of tutorials
- Education- fulfills SPE’s #1 qual.
- Sharing experiences with general membership (designers and users)
  - Paul- intention of session is training
  - Food or gift card for session?
  - Mike E- suggests if tutorial, NO panel
  - Paul- if room for both, we will do both
- Consider joint session with other divisions/SIGs
  - Don- Product Design & Development Division (PDDD)
  - Jan- he once gave a talk in PDDD and it was well-received
  - Keshor- one of founders of PDDD
LinkedIn Group for FAP SIG
- Paul- need someone to head group
- Could use for general questions/answers to current plastics failure issues
- Tricia- who can she work with within FAP SIG? Moderator needed. She discussed values of LinkedIn to BOD
Newsletter

- Remarks? Good
- Andy/Dale- to instruct Paul to do e-mail blasts one month prior to due date for papers and prior to deadline for call for papers
- Paul will put out newsletter in a few months to discuss ANTEC 2011
- Rabeh- suggested including ‘tips & tricks’
- Companies pay to have advertisements (business card, half or full page options)
- Paul suggested he will offer sponsorships & fees- no disagreements by BOD
- Paul- include abstracts for upcoming ANTEC
- Don- include snippets from authors of FAPSIG papers
  - Steve McLean (Sabic)- TD GC/MS
  - Andy- Half page on prevention
  - Jan- designing stroller seat
  - Chernovsky- best paper

ASM International collaboration (Don- ASM Education Committee liaison)
- JFAP- Don to be editor of special edition on plastics in conjunction w/FAP SIG

Other Topics
- Rabeh- give recognition to speakers (e.g. plaques are given to Injection Molding Division speakers)
- TPC elect responsibility- certificate w/gift card for speakers (can work with SPE to get gold seal)

FAPSIG Secretary – Jennifer Hoffman, Ph.D.
### Failure Analysis and Special Interest Group Board Members

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**Board Members**

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