WEAR NEWS

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STLE Annual meeting and Technical Conference

Venue

The Bally Hotel in Las Vegas Nevada, USA was the site of the STLE annual meeting. About 1600 people with interests in tribology attended the conference and exhibit. About 600 papers and 150 posters were presented at the conference. The commercial exhibit had about 125 exhibitors. The STLE committees met in conjunction with various sessions that they sponsored. Many business meetings were held after papers. Bally's Hotel is on the "strip" surrounded by similar hotels and casinos. Of course, attendees did not let these distractions interfere with their technical enlightenment.

Keynote

The highlight of the first day was the keynote that discussed the intricacies of gleaning power out of V-eight internal combustion engines. Dr. Alex Randolf from CRC described how they take small-block Chevy V-8 engines and urge their horsepower from about 250 to 850HP. They use techniques such as fuel injection, roller cams, DLC coatings on sliding surfaces, shaved pistons, and all sorts of coatings and other proprietary modifications. They build about 600 engines each year to be used in NASCAR racing events in Daytona and other places. Engines are tailored to accommodate specific track conditions. Some tracks require hours at 9000 rpm others require cycles at much lower rpm. Sprint cup engines only have to last one race so wear is not always an issue unless it causes a part to fail. The major tribology challenge is to overcome friction which robs horsepower.

Dr. Randolf ended his interesting talk by asking attendees to contact him with suggestions on how to squeeze more power out of Chevy small-block engines.

Content

The technical conference consisted of many concurrent sessions on many different subjects: lubrication fundamentals, greases, lubricants, additives, gears, metalworking fluids, wind energy, traction fluids, wear, tribology, biotribology, nanotechnology, surface engineering, and others. I only attended one wind turbine session, but it appears to me that the rolling element bearings in these devices are still failing at an unacceptable rate due to surface fatigue. The paper that I attended blamed the fatigue failures on "white-etching cracks", in the raceways and the author claimed that cracking was promoted by hydrogen generated by reaction of nascent metal surfaces with hydrocarbon oils. Who knew?

The following are some random "nuggets" gleaned from the papers that I attended.

- Sand with a dry hardness of 1050 HV will have a hardness of only 850 HV after 48 hours immersed in water.
- 80% of the world's supply of tungsten is in China and they have global control of this key material for hardmetals. Germany is trying to solve this dilemma with

hardmetals made from niobium (to make NbC/Ni cermets to do the job of WC/Co hardmetals). No other country (USA) seems to think that monopolization by China is an issue to be addressed.

- Use of poly alpha glycols (PAG) in long term use in electric turbine machinery will solve varnish buildup problems. Note: This was the most "attended" session that I observed at the four day conference. Varnish must be a big problem in turbines. Probably because oils may be in the machine for years.
- Ionic liquids (<1%) can be used to make nanoparticles stay in suspension in mineral oils.
- The planet's 800 million vehicles with internal combustion engines use 625,000 million liters of fuel each year and 33% of that fuel is used (wasted) in overcoming friction in vehicle tribosystems. Thus there is a consortium of government and industry trying to reduce friction in automotive tribosystems.
- The University of Florida has established a "Soft Matter" research effort to work on body parts that rub or need to be studied for other reasons. They are 3-D printing hydrogels in liquids to generate test shapes for rubbing studies. They claim that they can print cells and grow tumors on them.
- Impingement coating of solid lubricants is still alive. They put molybdenum disulfide in a sand blaster and blast surfaces.
- Oil "drill pipes" in ocean service are usually made from 13%Cr super martensitic stainless steel or duplex stainless steel. The former is much cheaper but at 30 HRC more difficult to cut and machine.
- Metal-working fluids are mostly water (85%) with a little emulsified oil and additives to suppress foam and biological issues.
- Modeling of tribosystems and molecular dynamics is alive and growing at a significant rate (in universities and non-USA institutes)
- The traditional 4-ball (and other EP lube tests) should be discontinued since they do not simulate any real tribosystem. The lubricant formulators have secret additives that they can add to any lube to make them pass mandated (and meaningless) EP oil tests.
- Boron carbide, which in cubic form is number two in hardness to diamond, is still in use.

Summary

Overall this was a very useful conference for practitioners. It is an opportunity for us material people to interface with the chemists that formulate the lubricants that are smothered on our materials in many tribosystems. Lubricant "tricks" to improve performance are getting sophisticated. They are trying very hard to put the nanoparticles that the material people are generating in lubricants without turning the result into a lapping compound.

Once again, STLE has provided a comfortable medium for the sharing of technologies and ideas. We thank them.

Gordon Research Conference on Tribology

The biannual Gordon Research Conference on Tribology was held at Bates College in Lewiston Maine USA from June 25 to July 1, 2016, The theme of this year's conference was "Scientific Advances for Critical Applications in Friction, Lubrication and Wear". There were invited speakers for each morning and evening session and each session had a theme:
Sunday – Tribology of Metals
Monday – Ultralow Friction Material and Mechanisms
Tuesday - Soft Materials: Rheology meets Tribology,
Wednesday - Tribology from Geo to Nano: Rate, Scale and State,
Thursday- Additives for the Next Generation of Lubricants.

The format of the conference is to have technical discussions in the mornings and evenings and the

afternoons are free. In recent years poster activity has replaced the afternoon sports activity. The plus side is that many students come to give a poster. There were at least 50 posters presented and awards were presented for the best. Student participation has become so significant that the students organize their own conference the day prior to the GRC. About 40 students participated. "Old" tribologists are not invited, but two professors are allowed in as advisors.

The first evening's sessions had to do with the friction of metal-to-metal couples. The first speaker was concerned with machining metals and how chips were formed and flow. He had incredible videos of chips being formed from various materials as they are machined. He used the term "unconfined plasticity" to describe the material situation during machining. His work suggested that cold-worked metal surfaces machine very different from annealed surfaces. The second speaker dealt with microstructural (grain size, orientation etc.) of pure metals rubbing on each other like gold-on-gold. He showed how rubbing friction can be low or high depending on microstructural effects.

Superlubricity appeared to still be alive. Ali Erdimir's group at Argonne National Lab is now heavy into nanotribology as are many other labs. It seems to be trendy to have a "nano" in the title of any lab and project.

Some of the invited speakers talked about the friction characteristics of the material that they were working with without stating what the material was rubbing against when they performed friction studies. People are still forgetting that friction is a system effect and that a material does not have a coefficient of friction. A mating couple has a coefficient of friction in a specific tribosystem.

Asperities are still dominating many scientific tribology studies and the engineering metrics for surfaces: lay, surface texture, and waviness, are still ignored. Several of the invited papers used power spectral density to describe surfaces being tribotested. I also got the impression that many labs get funding by finding new and improved ways to calculate real area of contact in sliding systems.

Two new-to-me subjects were triboelectrification and tribotonics. The former has to do with making usable electricity from the rubbing of non-conductors (as in static electricity on dry winter days). Tribotonics has to do with using ionic liquids as lubricants and by using voltage and current controls in the electrically-conducting oil to alter lubrication properties to suit different situations. If you see wear starting you can up the voltage a bit in the lubricant.

Another thing that was new to me was the use of nanodiamonds in lubricants. Everybody in the lubricants business has experimented with nanoparticles in oils only to find out that they made a lapping compound. Nanodiamonds (2 to 5 nm) are supposed to work without the abrasion effects.

The conference ended with a talk on the tribology of earthquakes where we found out that differential equations for slip velocity control everything.

In summary, this year's GRC on tribology was many faceted and full of the enthusiasm of youth. It appeared that the preponderance of attendees were in the early years of their careers. When I showed up at the last evening's traditional lobster dinner with a suit and tie I learned that I was the only person there who even knew of the tradition to dress for the last dinner. Everybody else was there in tee-shirts and flip-flops.

This conference is unlike all others. It is my favorite because it provides a unique opportunity for young and old researchers to mingle and learn from each other. I learned how to make a poster from a single PowerPoint slide and some people learned from me that they are supposed to dress for the last dinner. I really appreciate hearing what young researchers are doing and I marvel at how adroit they are with theory, instrumentation and use of digital data.

Rob Carpick from the University of Pennsylvania was the conference chair and Ashley Martini from The University of California at Merced was the

vice chair. Both are to be congratulated on a job well done.

ASTM G2 FRICTION, WEAR AND EROSION ACTIVITIES

The ASTM G2 Committee on Wear and Erosion met during an ASTM Committee Week in Belleville (Seattle) Washington on June 29 and 30 in conjunction with the ASTM D2 Committee on Fuels and Lubricants. The following are summaries of the various subcommittee meetings.

G02.5 Friction Activities

Scott Hummel (Lafayette College) chaired the meeting in absence of Chair Ken Budinski. (Bud Labs). A draft of a guide on the use of the slope of Ff vs. Fn curve as the coefficient of friction was deemed not necessary and the work item on the guide was cancelled.

G2.01 Erosion Activities

Chair John Hadjioannou reported that they will ballot ASTM G 73 standard for droplet erosion testing without change before the next meeting. The G 134 test method for erosion by cavitating jet immersed in water is still being modified for reapproval by Professor Soyama (University of Hokkaido). He is adding additional details in nozzle design and placement.

G2.3 Abrasion Activities

Chair Brian Merkel discussed the upcoming abrasion workshop and will take suggestions from the workshop on path forward in abrasion testing under advisement.

G2. 9 Terminology Activities

Chair Scott Hummel dealt with negatives received on terms balloted since the last meeting (Friction, Burnish, and Scuffing). The group in attendance offered alternate definitions and Scott with distill the information from the discussion into new definitions to be balloted before the next meeting.

Future meetings

Nov. 30 to Dec. 1, 2016 in Spring (Houston) Texas at EPI. Several tours and a workshop on abrasion are to be part of the meeting.

June 29 and 30, 2017 in Boston MA

Dec. 7 and 8, 2017 New Orleans Louisiana

Future Technical Activities

A workshop on Abrasion testing will be held in conjunction with the Fall 2016 meeting at EPI in Houston TX. The purpose of the workshop is to discuss problems with current abrasion testing techniques with an objective of addressing some of the problems with new standards or changes to existing standards.

Miscellaneous

John Hadjioannou, has been appointed Vice chairman of the G2 Committee replacing Greg Dalton (Tribsys).

In Memorium:

Peter Jost died on June 7 2016. He was the author of the "Jost Report" that publicized the costs of wear and erosion to the world. He was also the initiator of the World Tribology Congress. He will be missed by the field of tribology.

Shirley Swartz died May 8, 2016. She was well known as General Motors' lubrication expert. She and Donald Smolenski are responsible for the development of oil life monitors that are now standard equipment on many vehicles.

Note: Wear news is the informal account of selected tribology events and the activities of the ASTM G 2 Committee on Wear and Erosion

Contributed tribology articles are welcome. Send them and inquiries to Ken Budinski - Bud Labs USA, 3145 Dewey Ave Rochester, NY 14616

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