# Wear News

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## STLE Annual Meeting

### May 18-22, 2014

The annual meeting of STLE was held at a Disney resort hotel (Contemporary) near the Disney World complex in Orlando Florida, This conference usually draws about 1300 delegates from around the world and the emphasis of the conference is lubricated tribosystems. They also have papers on engineering materials that are used in lubricated tribosytems and some papers on nonlubricated tribosystems. There are always papers on rolling element bearings, plain bearings, prosthetic devices, gears, coatings and more recently materials of construction for wind turbines.

Overall it is a gathering that draws most of the tribology professionals in the world for networking and smoozing. The meeting also includes a commercial exhibit. It is here that lubricant designers can shop for new additives, materials engineers can shop for test rigs and measuring devices, and academicians can get equipment candidates for their capital budget.

The conference luncheon is used to grant awards to STLE members and others in the field of tribology. This year Professor Bharat Bhushan from Ohio State University received the STLE Lifetime Achievement Award.

I have been using this conference to shop for a lab test to screen oils. One paper suggested that a cylinder on flat is the most appropriate sample configuration. There is a trend to try to make oils better by putting nanoparticles in them. Point contact geometries tend to not respond to these particles like an actual tribosystem would. Also one speaker reported that fully formulate oils tend to treat nanoparticles as contaminants and counter their effect (treat like dirt).

A unique feature of the STLE annual meeting is technical presentations from commercial organizations: commercial marketing forums. To me, they are often the best talks. The presenters are marketing something, but they seem to-do the best testing to prove that their product is superior to others. The speakers are usually very experienced in their field and they can answer the tough questions.

The most heavily attended sessions tended to deal with lubrication fundamentals. Attendees seem to have a quest for mechanisms and understanding why things happen.

Some things that I heard at STLE talks:

*Cylinder-on-flat is the preferred geometry for Stribeck curve testing
*Martens (of Martensite fame) from BAM in Germany, made the first Stribeck curve in the 1890.s
* The results obtained in pin-on-disk test depend on which material is the pin and which is the disk
* Rubbing diamond on diamond transforms the rubbing surfaces to amorphous carbon
*The thermal limit for engine oils is about 250C
* Japan is installing the infrastructure to allow widespread use of hydrogen as a vehicle fuel
* The greater the interference fit in shrink fits, the greater the potential for fretting fatigue damage.
* Fully formulated oils do not allow tribofilm formation on DLC coatings

* Thicker tribofilms do not guarantee reduced wear
*PTFE particles added to grease sometimes improve performance.
* Molybdenum disulfide is the best additive particle for grease
* Coal still provides 40% of the world's energy
* Oil additives can be formulated to neutralize abrasive particles that may be present.
* Film thickness under EHD conditions is about 150 nm
* The range for electric vehicles is typically 50% of the stated range.
* Natural gas requires too much storage space to be a practical option for motor vehicles.
* The US government is working on a "smart grid" that twill "rain down" charging current for electric vehicle (really)
* There are currently 18 billion vehicles on our planet and only 18% of the population have vehicles at present.
*The US government metric for auto pollution is grams of carbon produced per mile
* Varnish is degraded oil that is suspended in oil, but starts to deposit on surfaces that become chemically active from rubbing.
* Niobium carbide is showing promise as a replacement for tungsten carbide.
* Use counter rotation in a Timken test to produce scuffing.

**Summary**

The STLE meeting continues to be the place to be seen. This year's meeting attracted more than 500 papers, 150 more than last year's, The talks covered most aspects of tribology and STLE does a great job on organizing the event and making it run smoothly. Of course, the Disney organization did their usual superstar job with the facilities. The hotel was in the middle of nowhere, but Disney supplies everything needed in their nowhere locations. The STLE organizers and Disney are to be commended on a job well done.

## ASTM G 2 Friction and Wear Activities

The ASTM Committee on Wear and Erosion's spring meeting was held on the Thursday and Friday after the STLE meeting at the Disney Resort in Orlando. The meeting started with task group meetings followed by subcommittee meetings and the full committee meeting.

The following is synopsis of the meeting:

**Work Group on the twist compression test**

Greg Dalton (Tribsys) balloted a strawman standard on a galling test that involves multiple rotations of an annulus rider on a flat sheet metal counterface. The test is intended to simulate the galling and "pickup" that commonly occurs in drawing and forming sheet metal parts on punch presses. These steels are usually lubricated and an important application of the test is evaluating the efficacy of drawing lubricants.

The work group chair, Greg Dalton, reviewed the last standard ballot and after considerable discussion a list of items to be addressed in the next ballot was formulated:

1. Establish a firm test metric
2. Number of test replicates
3. Specimen cleaning procedure
4. Establish specimen drawings
5. Establish specimen holding requirements
6. Establish specimen flatness requirements
7. Establish surface roughness limits
8. Establish the annulus (tool) material
9. Establish the start conditions for the test
10. Establish rotation requirements

Task Group Chair, Greg Dalton will prepare a second ballot that addresses these issues.

**Work Group on ASTM G 65 to allow the use of Neoprene wheels**

Troy LeValley (Falex) chairs this work group and they have been investigating changing the ASTM

G 65 dry sand rubber wheel abrasion test to allow the use of neoprene rubber to replace the current chlorobutyl rubber (CBR) for the wheel that forces the abrasive against the test specimen. An interlaboratory test of six labs was conducted on the neoprene using a D2 tool steel test coupon. The coefficient of variation ranged from 0.07 to 0.15 with less than 0.1 being the goal. The test participants were of the opinion that the neoprene produced results similar to the CBR wheel. The standard will be revised to allow its use but users will have to report on which wheel they used in tests.

There was much discussion on the problems that exist on getting CBR wheels and the net effort of the work group deliberation was that John Hadjaneaou (EPI) agreed to revise the G 65 standard to allow the use of Neoprene and ballot it at the subcommittee level..

**Erosion Activities**

The subcommittee meeting was chaired by John Hadjaneaou. Jeff Smith and Swami Swaminathan participated by WebEx and they reported that the last ballot of the elevated temperature solid particle erosion test received a number of negatives. The remainder of the meeting was dedicated to resolution of the negatives.

One negative was voted not- persuasive and some negatives were withdrawn. The standard will go forward towards publication. Subcommittee chair John Hadjaneaou agreed to monitor the progress of the standard through the publication process..

**Abrasion Activities**

Brian Merkle (Nanosteel) chaired the abrasion subcommittee meeting. The first item of business was to review standards that are in need of review and preapproval. John Hadjaneaou agreed to review ASTM G 105 the wet sand rubber wheel abrasion test; Peter Blau agreed to review the G171 scratch test; Nick Randall will ask Ray Bayer to review the ASTM G 56 paper abrasion test. Jim Miller will try to put in a new Mil Spec reference for the rubber used in the G 75 Miller Number test.

Under new business, Peter Blau will update the G171 scratch test to allow the use of profilometry to measure scratch cross-section dimensions.

Hugh Thurman made a presentation at the spring meeting on the development of an abrasion test for "wear of dentifrice materials. He reported that there is an ISO standard for removal of tooth enamel in brushing but it uses radionuclides and this limits its applicability. He proposes a test using a standard tooth paste and profilometry to measure tooth material removal. He will draft a strawman standard for subcommittee ballot.

Ken Budinski (Bud Labs) reported that the G 174 loop abrasion test has been reviewed and that it is ready for a reapproval ballot.
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**Data Acquisition Activities.**

Chair Greg Dalton(Tribsys) reported that the subcommittee is working on withdrawal of the G 118 standard on data suitable for data bases . The ASTM G 190 guide on wear test selection. will then be reviewed and revised to include material from the cancelled G 118 standard. Greg will establish a work item on these projects.

**Non Abrasive Wear Activities**

Nick Randall (CSM) chaired the spring 2014 meeting in Orlando. The ballot results on G 196 will be deferred to the next meeting in San Diego. It was reported that Scott Hummel is rewriting G98 to use test couples like G 196.

A number of standards are up for review for preapproval. Some meeting attendees agreed to do reviews:

G 137 – pin-on-sandpaper test – Troy LeValley will review
G 176 – plastic block-on-ring test – Troy LeValley will review.
G 77 – metal block-on-ring – Troy LeValley will review
G 99 – pin-on-disk test – Nick Randall and Peter Blau will review

Ken Budinski will ballot the precision and bias statement for G 204 fretting test.

Troy LeValley will assume Mike Anderson's position as vice chair of the abrasion subcommittee.

**Friction Activities**

Friction Subcommittee chair Ken Budinski (Bud Labs) discussed the need to have a ballot on the addition of a tolerance on the angles of the inclined plane friction test for rolling element bearings.

The only new activity under consideration in the subcommittee is the development of a standard on the use and interpretation of friction measurements.

The subject of lubricated friction was discussed, but it appeared to be the consensus that the block and ring test adequately treats the subject.

**Terminology Activities**

Subcommittee Chair Peter Blau reported that four terms were balloted since the last meeting: :

1. Friction loop
2. Friction log
3. Biotribocorrosion
4. Friction

Negatives and comments were received on all terms. After discussing all of these terms with the meeting attendees, it was decided to reballot "friction loop" with the clarifying note removed, to permanently withdraw friction log (not a widely used term), to refer "Biotribocorrosion" to people working in the medical field and to reballot "friction" after addressing the negatives.

There was also discussion at the meeting on the use of graphics in definitions. Ken Budinski agreed to submit a photo of galling. Scuffing was also proposed at the meeting as a term needing a G40 definition.

## Miscellany

**Future Meetings:**

Dec.7-11, 2014 SanDiego CA (with D2)

April 16-17, 2015 Toronto (with WOM)

Dec. 9-10, Austin TX, 2015

June 29-30, Belleview Washington 2016

**Committee Officers for 2014 to 2016:**

Steve Shaffer – Chair

Greg Dalton – Vice Chair

Troy LeValley – Secretary

## Gordon Research Conference on Tribology

The biennial Gordon Research Conference (GRC) on Tribology was held from July 20 to 25 at Bentley University in Waltham Massachusetts, USA (a suburb of Boston). This year's theme was "Couple challenges at the mating interface". All of the conference speakers were invited. The conference format is to have talks in the morning and evening and the afternoons are free. There were also two poster sessions each with about 50

posters. About 150 attended the conference and this is a higher number than usual.

Talks are not published and the work discussed is supposed to be cutting edge. A highlight of this GRC on tribology was a student seminar on the day before the formal conference. The students arranged the program, gave the talks and only a few "seniors" were invited to monitor the event. About 50 graduate students from around the world attended the event.

The conference organizers made a special effort in recent years to make the tribology conference the place for students to meet and collaborate with senior researchers.in the field. As one might expect, the young speakers displayed their computer and computational prowess and wowed us with video clips of all sorts of wear events.

A prerequisite for most presentations appeared to be that experimental results had to be compared with a computed model and the work was not good unless it correlated with the model. There were no talks on abrasion or wear failures of tools and machines. Friction seemed to be the most sought-after test result. Unfortunate may speakers treated coefficient of friction as a property of a material rather than the product of a couple and a sliding system, but this situation prevails in other conferences as well. Everybody seems to be seeking zero friction because of the global emphasis on saving energy.

Overall the conference organizers (Roland Benewitz from Leibnig Institute in Germany was Chair, and Professor Robert Carpick from the University of Pennsylvania as vice chair) did a great job with the details and everybody left the event with something of substance. They are to be congratulated on a job well done.

## Second International Conference on Abrasive Processes, September 7 to 10 2014 Cambridge University, UK

This conference is an outgrowth of the ELSI conferences that wear held at Cambridge University in 1979, 1983, 1987, and 1994. ELSI was the acronym for "Erosion by solid and liquid impact". Erosion was dropped from the title because of a diminishing emphasis of this field in tribology research. These types of erosion are of great importance in selected industries, like power generation, aircraft and aerospace, but not enough workers were left to support a separate conference. Thus, this conference was expanded to include abrasion which is still a popular avenue of research. In addition, an abrasion conference fits the scope of the organizing organizations: The Institute for Manufacturing (IFM) and the Tribology Division of Institute of physics at Cambridge University, and the Institution of Mechanical Engineers.

The conference consisted of forty papers and a similar number of posters over three days. It was attended by about 50 delegates . There were four keynote speakers:

1. Jan Spelt (University of Toronto) Vibratory Finishing
2. Margaret Stack (university of Strathclide) – Tribocorrosoin
3. Prof. Uhlman (Technical University of Berlin) Machining with Abrasives
4. John Nicholls, Cranfield university) Erosion by Volcanic Ash

The conference sessions had these titles:

Abrasive Processing I
Abrasion and Erosion I
Abrasion and Erosion II
Abrasive Processing II
Abrasion and Erosion III
Scratch Testing
Abrasion and Erosion IV
Abrasion and Erosion V

The "process" sessions covered grinding, lapping, vibratory finishing and the like – subjects not common to most tribology conferences. It was very refreshing to hear about the useful applications of abrasion. In the area of erosion, we heard talks about solid particle, slurry, and droplet erosion (like the old ELSI conferences). We even had an interesting talk on the physics of droplet impacts.

The abrasion talks often involved the use of microabrasion or use or the ball-cratering machine as it is known in some circles. This test rubs a ball against a fixed flat plate and abrasive-filled slurry is metered into the vertical ball/flat interface. As a recovering user of this test, I was very interested in a paper by a Brazilian researcher that questioned the ability of this test to rank tool steels the way that they are ranked for wear resistance by users and their manufacturers. For example, the author found H13 tool steel at 53 HRC to be more abrasion resistant (per microabrason test) than a 9%V air hardening tool steel at 60 HRC. that is widely used for punch press tooling. Other papers on the microabrasion test cited issues with rolling grits versus fixed grits, corrosion, ball roughness, abrasive size, and type and slurry concentration. There were no papers on the ASTM G 174 loop abrasion test that does not have any of these sorts of problems.

Overall, this was a great conference. John Williams and Ian Hutchings are to be congratulated for their significant effort in making the conference a success. The venue was outstanding; the papers and posters were timely and dealt with important subjects. This conference made a significant contribution to tribology.

Wear News is the informal account of the proceedings of the ASTM G2 committee on Wear and Erosion and selected related tribology events. Contributions on tribology topics are welcome. Send them to:

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