WEAR NEWS

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Gordon Research Conference on Tribology

The GRC on tribology is held every two years at a small, usually private, New England college. This year's GRC was held at Bates College in Lewiston Maine, June 24 to June 29, 2018. All speakers are invited and the format is: lectures in the morning, afternoons free till poster time at 4 PM, and lectures from 7:30 to 9:00 in the evening. There was a student conference on Tribology on the Sunday before the regular GRC. The students run it and a few old tribologists are allowed in as chaperones.

The first night (Sunday) talks included videos on AFM tips rubbing on crumpled graphite, sliding on soft hydrogels (for joints) and how slip velocity correlates with the tendency for earthquakes.

Day two we heard about the myriad of details involved in additive manufacturing. It was emphasized that porosity is the weak link in the process. It can be 5%. Other talks showed how profilometry coupled with XPS and Raman can be used to fully characterize tribofilms in wear scars.

An interesting talk from day three proposed that forces applied to a rubbing surface supply the activation energy for tribochemical reactions. For example, if you mortar and pestle the mineral cinnabar, you create mercury. And this was documented in 332 BC. Who knew?

There were lots of models discussed. One speaker presented a model to deduce the life of an oil from pin-on-disk tests, but there so many undefined parameters used in the calculations that one had to accept them as correct. Another talk on lubricants discussed how polymers are added to oils as viscosity improvers, but these polymers can break down with pressure and temperature and the speaker discussed ways to compare the efficacy of different polymer additives. One model showed how to calculate the allowable shear stress of moly disulfide.

Tribocorrosion was a somewhat new topic of discussion. One speaker showed how one can deduce the chemical effects of individual microconstituents, by converting an AFM in a polarization cell.

There were lots of molecular dynamics discussions. One presentation demonstrated that diamond on diamond under conditions of low humidity was low friction.

Finally, I learned how facets can be ground on diamonds. Diamond rubbing on diamond creates shear-induced amorphousization and the amorphous reaction product can be easily swept away by the polishing lap (cast iron with diamond powder in olive oil).

Some of the speakers used amazing technology in their talks. One speaker made videos of wear in real time in a TEM. You could see wear events starting at the nano-size scale. Somebody even did nano indentation studies on a single soot particle with a diameter of about 20 nm. The hardness was about 20 GPa.

As had been the case with dozen or so GRC's that I attended, there was almost no industry problems discussed. Most speakers were academicians, who received funding from governments and governments seem to only fund things done for the sake of science rather than for science directed at some practical goal. However, that is allegedly the purpose of GRC: present information that is new and unpublished not necessarily aimed at any particular goal.

GRC is my favorite conference because it is about things that I would never work on because all that I work on has to have financial justification.

This years' conference was chaired by Ashlie Martini, from the University of California at Merced. Overall it was a great conference and Ashlie is to be congratulated on a job well done.

Ken Budinski

STLE Annual Meeting

The annual meeting of the Society of Lubrication Engineers and Tribologists was held from May 20 to 25, 2018 in Minneapolis Minnesota in the USA. The conference was held at the convention center and it had the usual format of as many as 30 concurrent papers. The conference was coupled with an exhibit with about 150 booths. Attendees came from about 40 countries and they numbered about 1300. They seemed to have too many talk categories, but with over 500 talks it is not unreasonable to have about 30 talk categories.

The largest session attendance that I observed was in the commercial forum – talks by companies relating to their products. I went to one talk by Afton Chemicals on the future of manufacturing in America. The speaker painted a pretty grim (to me) picture. Manufacturing is now only about 15 % of our economy and it is declining each year. We import 2 trillion dollars' worth of stuff that used to be made in the USA. The service sector employs 75% of the workforce in the USA (from those who are willing to work) and 90 % of our patents and R&D is sponsored by our disappearing manufacturing.

So what happened? How did America lose "everything"? The speaker placed the blame on global marketing and cellphones. "Global Marketing" is a euphemism for moving manufacturing to the country with the current lowest labor cost. Cellphone and phonophile behavior have made it possible to move everything to low cost countries and to replace retail and everything else to on-line ordering to sources anywhere on the planet.

The speaker tried to end his talk with an upbeat prediction calling America's "home market of 320 million" a big help, but he really could not cite any specific success stories. The best he could come up with was how Facebook did not exist 10 years ago and now they have 2.1 billion users. But what do they make? Where are their employees?

The following are some additional takeaways from the conference:

- Sealand Corporation is a distributor for all of the additives that one could think of for oils.
- Austempered ductile iron has better wear resistance (vs. hard steel) than quenched and tempered ductile iron
- Sulfur additives in oil tend to corrode gear teeth
- "Tribomechdynamics" is a new term for the behavior of joints
- The Chinese frack with manufactured spheres while we use round and subangular sand
- High–speed trains in China use copper-based composites for brakes (46-55%Cu, 10-12%Fe, 6-8% zirconia

- Polycrystalline diamond is made by wicking liquid cobalt into diamond powder preforms
- Polished WC/Co rock cutters steer better than rough WC/Co or PCD (for fracking)
- Rolling contact fatigue can be evaluated on a PCS machine with three disks riding on a small steel hub
- Power spectral density is creeping back into the field of surface texture measurement (beware of it)
- The abrasion resistance of 304 stainless steel can be doubled by deep cryogenic treatment
- Spiral grooves in a shaft can prevent abrasion from dirt that may get into the contact
- Aircraft engine oils (mil spec) are life tested for 3000 hours at 10,000 rpm and 429,000 psi Hertz stress.
- Dry rolling of ball bearings produces fatigue cracks at the tip of the Hertz contact
- It costs $150,000 to develop an App and one billion dollars to develop an FDA-approved drug
- The area of a Hertz contact is proportional to the force to the 2/3 power
- Metals are ductile and sticky; that is why they wear
- Additive manufacturing is widely used for hydraulic and pneumatic control parts (in China)
- Esters (to 10%) improve the life of automatic transmission fluids

I also spent an afternoon with the hydrogel people. This seems to be a hot research area in biotribology. These researchers seem to be predominately young and most are working on wear and friction of body parts.

Overall this meeting was very worthwhile. It is the event to go to and see who is doing what, and to see what students are doing at universities. Minneapolis was clean, cold, windy and safe. People there are nice and they move about the city center in miles of elevated tunnels. I suspect that one is in jeopardy outside of the tunnels in the winter. America owes a debt of gratitude to these stalwart people for tending to an uninhabitable part of America. We thank you. Overall, it was a great meeting and STLE is to be congratulated for making it happen.

ASTM G2 FRICTION, WEAR AND EROSION ACTIVITIES

The ASTM G2 Committee on Wear and Erosion Spring 2018 meeting was held on June 22 at ASTM headquarters in West Conshohocken PA. The following are brief summaries of the subcommittee meetings.

G02.50 Friction Activities

Chair Ken Budinski. (Bud Labs) reported that a new standard for an inclined plane test was balloted and there was one comment and one negative that could be resolved with some wordsmithing and a new illustration. Both were accomplished with the help of the ASTM Staff Manager, James Ferrell. The standard should now move forward.

G02.10 Erosion Activities

Chair John Hadjioannou (EPI) reported that negatives on a review of G76 solid particle erosion test were addressed in a previous ballot, but new comments were received on designation of the test abrasive and these will have to be addressed. These terms also need definition.

erosion rate
erodent
erosion resistance
solid particle

Ken Budinski will add these terms as well as a section on guidance on use of other abrasives and impingement angles.

John reported that the ISO Committee on protective coatings wanted to work with G2 on a standard for droplet erosion that uses different test equipment than that used in the ASTM G 73 test.

Professor Tehosh Soyama (Morana Institute, Japan) reported that he balloted a revision of the cavitation test that uses a submerged high pressure water jet. He received a number of comments in the ballot. The comments were discussed and changes to a figure in the standard were proposed to address some of the comments. Professor Soyama will make the changes as editorial.

G02.30 Abrasion Activities

The subcommittee meeting was chaired by Brian Merkle (Lincoln Electric). Brian reported that ASTM G 56 on abrasivity of ribbons needs to be updated so the test can be used on paper and other films. The title should also be changed to reflect the increased scope. Steve Shaffer (Bruker) volunteered to do the update and reballot the standard.

Chair Merkle reported that the ASTM B611 High Stress Abrasion Test for Cemented Carbides needs review for reapproval. John Hadjioannou wants to have the high stress abrasion test ASTM B 611 use 1080 steel for the wheel. He will make appropriate changes to the standard and ballot them.

John also made a presentation on changing the ASTM G 65 abrasion test to allow the use of alumina as the test abrasive. He will form a new work group to develop a new method for low-stress abrasion testing using alumina instead of sand as the test abradant.

Brian also reported that the jaw crusher test method is in need for reapproval.

Alan Jeaneke (Taber) volunteered to review the Taber Abrader that is in need of review.

G02. 40 Non- abrasive Wear Activities

Chair Nick Randall (Anton Paar) will take care of reballoting of ASTM G99 and G 133.

Nick also made a presentation on the use of lighter loads in the G99 pin-on-disk test. His presentation showed results on the effect of varying speed, loads and other factors. Nick will put his proposed low-load test in the form of a revision to G 99 and ballot it.

G02 Tribotest Development Activities

G2 Chair John Hadjioannou reported that he has conducted test using alumina in the G65 dry sand rubber wheel in an attempt to make the test more aggressive and applicable to carbides and the like that barely respond to sand abrasion.

John also reported that a request has been made for a new standard for ranking the resistance of hardfacing overlays to impact. A draft of the standard was reviewed and it was recommended that the authors establish a work item on the test. In the proposed test, specimens are affixed to the inside diameter of a large cylinder and a shaft rotates within the cylinder carrying a wire rope with steel balls on it: visualize a weed-wacker inside of a pipe.

John also mentioned that work is still underway in updating ASTM G 190 on test selection.

G2. 90 Terminology Activities

Chair Scott Hummel (Lafayette College) reported that the term “scuffing” received a negative from Mark Gee (NPL). Mark suggested not defining the

term since the committee does not have a scuffing test. Scott will resolve the issue with Mark.

Peter Blau (consultant) will set up a new work group to improve the committee's terminology in ASTM G 40.

Future meetings

Dec. 12 and 13, 2018 in Atlanta GA, with D2.

June 24-29, 2019 Denver CO, with D2

Miscellaneous

Possible future workshop topics:

Tribotesting needs
ASTM G 65
Friction outputs

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
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