20 Minutes With...

Dr. Norm Gitis

By Karl M. Phipps
Managing Editor

Since coming to the U.S., this Russian-born scientist has transformed the tribology test-equipment industry as president and CEO of his own award-winning private company.

Professional experience

- Center for Tribology, Inc., Campbell, Calif., President & CEO, 2000-present.
- Center for Tribology, Inc., Campbell, Calif., President & Founder, 1994-2000.
- Maxtor, San Jose, Calif., Tribology Manager, 1992-1993.
- IBM, San Jose, Calif., Advisory Engineer, 1989-1992.
- USSR Center for Machine Tools and Robotics, Senior Lead Scientist, Moscow, Russia, 1984-1988.
- Petrochemical University, Adjunct Professor, Moscow, Russia, 1986-1988.
- Tribology Center of USSR Academy of Sciences, Research Scientist, Moscow, Russia, 1978-1983.

Education

- USSR Academy of Sciences, Moscow, Russia. Doctorate in Mechanical Engineering & Tribology, 1983.
- USSR Polytechnic University, Moscow, Russia. Master of Science in Mechanical Engineering, 1978.

Professional Affiliations

- STLE, 1990-present.
  - Tribotesting Technical Committee (Chairman, 1998-present).
- International Disk Drive Equipment and Materials Association, 1993-2006.
- ASTM (Vice-Chairman of G-02.40 Subcommittee on Wear, 2000-2005).
- ASME Tribology Division (1991-2000).
- ASME Research Committee on Tribology (1996-1998).

Awards and Honors

- STLE Fellow, 2006.
- Tribology Society of India (Life Member), 2005.
- Guest Professor at JiLin University, China, 2002.
- CEO of No. 1 Fastest Growing Private Company in Silicon Valley, Calif., 1997.
- Summa Cum Laude Graduate, USSR Polytechnic University, Moscow, Russia, 1978.

What type of research were you doing before you came to the United States?

In my native country of Russia, I worked at the Tribology Center of the USSR Academy of Sciences under one of the founders of modern tribology, professor Igor Kragelsky. I studied a film-starvation effect of lubricating oils and greases in boundary lubrication, which was the topic of my doctoral thesis. For an experimental part of that project, I pioneered and patented the use of electrical resistance and acoustic emission signals to supplement friction measurements, participated in the development of solid lubricants for space applications and organized monthly academic seminars on theory of friction and wear.

Then I moved to the USSR Center for Machine Tools, where I led research and development projects on a stick-slip (auto-oscillations) effect, its modeling and prevention in machine tool slideways by way of the use of anti-stick-slip "way oils," Teflon® and epoxy-based polymers. As a result, I obtained several patents and published three books, one on the academic understanding of the phenomenon of stiction and friction-induced auto-oscillations and two others on practical aspects of stiction and oscillations reduction and prevention. At that time, I actively developed and researched new methods and apparatuses for tribological testing of lubricants, polymers and metals for which I received other patents.

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Were there any American tribologists who helped you when you immigrated?
Yes, I was deeply touched and will always remain grateful for the warm and kind reception by the tribology community in this country. There were so many people, including fellow STLE members, who opened their hearts and helped me very much when I arrived in the United States. I especially want to acknowledge professors Nam Suh, Ernest Rabinovitch and Nanaji Saka at MIT; Ward Winer and Itzhak Green at Georgia Tech; George Adams at Northeastern University; Jacob Israelachvili at the University of California; and Steve Granick at the University of Illinois for their tremendous support when it was needed.

Why did you become interested in magnetic drive tribology?
During my stay at MIT, where I was a visiting professor, I discovered a computer disc drive and learned about its tribological challenges. Naturally, I got excited about the magnetic media having ultrathin coatings and lubricants and ultra smooth surface roughness on the order of nanometers, which represented a new challenge for traditional tribology. Later I applied for a job at IBM in San Jose, Calif., (the birthplace of magnetic disk drives) and moved to Silicon Valley, where I worked on head and media stiction, lubrication, roughness and wear for both tape and disc drives.

Though most of my work at IBM was in applied research, I managed to deepen the understanding of the stiction phenomenon by authoring several papers with Drs. Leo Volpe and Richard Sonnenfeld. Three years later I went on to become tribology manager at Maxtor, a leading drive manufacturer, where I was involved in durability and failure analysis issues with drives in high-volume production as well as in charge of solving tribological challenges for new drive designs, including world-first drive with glass media (in cooperation with Hoya Corp.), world-first drive with a head-to-disc gap less than 3 micro-inches and so-called “tri-pad” head slider (in cooperation with Read-Rite Corp.), and world-first drive for contact recording (in cooperation with the now-defunct Censtor Corp. and in hot competition with Fujitsu, Ltd.).

Why did you decide to create your own company?
At the time, tribology labs in Russia were poorly equipped, mostly with homemade primitive testers. I was surprised to find out that leading academic and industrial tribology labs in the U.S. also suffer from a lack of quality test equipment. As a result, the published tribology data is not as reproducible and reliable as needed by tribology customers—machine design and materials engineers. During my career, I have continuously been improving test equipment and procedures for experimental measurements of friction and wear, so I decided to start my own company focusing on developing repeatable test equipment and procedures for various tribological applications.

How difficult a transition was it working in the corporate world to start your own business?
In 1993 we started the Center for Tribology, Inc. (CETR), with no sizeable investment. Revenues from consulting were invested in building a testing lab, and then the testing fees were invested in hiring engineers and starting design and production of testers. The biggest difficulties in transitioning from the academic and corporate world to the small business environment was the absence of a regular paycheck and the absence of the supporting infrastructure, each and every element of which we had to build by ourselves.

Then there was something else I hadn’t counted on—a quiet telephone. At my last job I was accustomed to getting dozens of voice messages daily, but during the first several months of CETR I was getting almost none, since most prospective customers did not rush to return phone calls to this yet-unknown, yet-unproven startup company. Thanks to our successful sensor and tester design and a clear, strong focus on helping customers solve their tribology problems, our client listing more than tripled each year from 1994-1997, and we quickly became the world’s largest supplier of tribology test equipment. In 1998 CETR was named the fastest-growing private corporation in Northern California by *The Business Journal*.

What kinds of products and services does CETR provide?

Our main product has been a universal testing platform series, UMT, which allows users to perform all tribological and mechanical tests of lubricants and materials. It has a modular design with all types of motion for both upper and lower specimens (rotations around X, Y and Z, linear sliding in X, Y and Z) that are synchronized so users can produce a zig-zag or spiral wear track combining upper-linear and lower-rotary motions or butterfly wings combining upper-linear and lower-linear motions.

The UMT has a speed range of seven orders of magnitude, from 0.001 to 10,000 rpm and a load range of 10 orders of magnitude from 0.1 μN to 1 kN, with the oscillating motion frequency up to 60 Hz. The unique servo-control of loads and displacements allows for precision and repeatable tests with *in situ* monitoring of all common tribological parameters: normal load and wear depth, friction force, torque and coefficient, contact acoustic emission and electrical resistance, humidity and temperature. Optional digital optical microscope and AFM modules help observe surface damage without sample removal. Various chambers for heating and cooling, humidity and gases, vacuum and other environmental conditions also are optional modules.

Over the years, we have developed its three interchangeable configurations:

- Universal nano+micro materials tester UNMT-1 with nano-indenter, atomic force microscope and other nanotechnology modules for studies of nanocoatings and nanostructured materials.
- Universal microtribometer UMT-2 for all common tests of coatings and bulk materials.
- Universal macrotribometer UMT-3 for all common tests of lubricants, including in ball/pin-on-disc, disc-on-disc, block-on-ring, 4-balls, piston/ring-on-cylinder and many other modes.

There is no standard tribology test of lubricants or coatings that you would not be able to perform on the UMT testers.

For lubricating oils, it is the world-first tester with automatic Stribeck curve acquisition and analysis. That is, it automatically goes to different levels of load or speed, monitors friction coefficient and electrical resistance on each level and then plots their average values vs. load and speed.

For thin and thick coatings, whether hard or soft, it is the world-first tester with comprehensive mechanical characterization, including nano- and micro-hardness, Young's modulus, scratch and wear resistance, adhesion and delamination, friction and surface topography, etc.

In addition to the universal testers that represent 75% of CETR's business, CETR makes specialized tribology testers for a magnetic head-disk interface (over 2,000 of them have been sold!) and chemical-mechanical polishing of semiconductor wafers. For quality control in volume production, CETR makes specialized testers for inkjet printer cartridges and razor blades.

What is your company's sales geography?

About half of our sales come from Asia, mostly from China, Japan, Korea, Taiwan and Singapore. Our U.S. sales are up to 35%, while in Europe they are at 15%.


(Photo courtesy of Center of Tribology, Inc.)

Pictured is CETR's leading product, the universal testing platform series, UMT, which allows users to perform tribological and mechanical tests of lubricants and materials.

To support our worldwide customers, CETR opened a sales and technical services office in Shanghai, China. The time difference between our U.S. and China offices has enabled CETR to maintain 24-hour phone and e-mail support service for all our global customers.

What is the secret of CETR's success?

That's a good question. I cannot single out any one reason for our success as there are several possibilities.

Technically, CETR has been the technology leader. We have developed and patented the most repeatable sensors in the world, measuring simultaneously and independently vertical load and tangential friction force (or torque) as well as acoustic emission sensors with unique amplitude-frequency characteristics for the highest sensitivity to tiniest wear, pitting and scratches, while most of our competitors buy regular primitive sensors on the market. The UMT is capable of measuring all six forces and torques simultaneously, while traditional tribometers measure only friction

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Our main product has been a universal testing platform series, UMT, which allows users to perform all tribological and mechanical tests of lubricants and materials.

force in one direction.

CETR was the first to develop a multi-sensor technology with many complimentary signals, like high-frequency acoustics, electrical resistance, digital optical microscopy, etc. Though some competitors are trying to match our multichannel offerings, their signals still need to be improved. The UMT was the world's first tribometer with a closed-loop, servo-control of normal load, which dramatically improves test repeatability and precision. In addition, the UMT was the world's first tribometer with completely computerized and synchronized control of multiple motions and multichannel, high-frequency data acquisition. The UMT was the world's first tribometer with a truly modular design in which various motion and signal modules can be installed or removed within a couple of minutes. The UMT has unmatched ranges of computer-controlled motions, speeds, forces and environmental conditions.

Scientifically, CETR has hired several employees who have doctorates and, thus, possesses deep tribology expertise, which allows us to help customers solve their tribology problems instead of just selling them a piece of hardware. A common joke at CETR is that with most industrial customers it is hard to tell whether we sell a tester with free-of-charge, specially-developed test procedures or we sell effective test procedures with a free-of-charge tester.

In business terms, CETR has widened the applications of tribology and tribometers from traditional lubricant testing to such diverse applications as mechanical testing of coatings and thin films, metals and ceramics, polymers and elastomers, biomedical devices and materials, hair and skin, MEMS and wafers, flat-panel displays and more. In our customers' eyes, CETR provides effective high-tech solutions with an emphasis on continuous technical and scientific support.

What was the most unusual test rig your company has ever made?

As I just mentioned, our main product is the universal tester, but every month our engineers develop new modules or modify its existent modules. To test how razor blades maintain their sharpness per the customer's test procedure, we have made a special linear drive with a felt soaked in hot, soapy water, then enabled multiple cuts of blades into the felt with monitoring the maximum cutting force at the constant cutting depth.

To test human skin on the forearm *in-vivo*, we have made a special arm support comfortable for volunteers. To test how dishwashing liquid is rinsed off, we developed a special test in which a ceramic dish is poured on to first with the soapy washing liquid until a low friction is stabilized, then with water until stick-slip develops, measuring the time to stick-slip. We designed fixtures for the UMT linearly reciprocating drive for such diverse tests as piston ring cylinder, surgical sutures and crossed-hair. To test ultrathin films and coatings, we developed a new module called nano-analyzer, which combines imaging capabilities of an AFM with mechanical capabilities of an indenter and scratcher but does not require any measurable depth of penetration.

What impact has STLE had on your career?

STLE has been a big part of my life. As soon as I came to the U.S., I immediately applied for membership. In 1993 and 1994, I organized plenary discussions on the nature of friction at annual meetings in Calgary and Pittsburgh that attracted record attendance and interest. I remembered Dr. Chris DellaCorte of NASA helped me a great deal to co-chair and conduct them.

In 1997 I made a proposal to STLE's Board of Directors to form a new technical committee on tribotesting. The board approved the plan to create a committee that year. Since 1998 I have been the committee chair and have organized several technical sessions at each annual meeting. For his invaluable support, I have to acknowledge Dr. Albert Segall of Penn State University, an STLE member, for serving as paper solicitation chairman for the last several years.

In addition, at last year's annual meeting in Calgary, I was elected a Fellow, which was a special milestone. It's been a real honor and privilege to be involved with STLE. I've enjoyed many good times and met many colleagues at past annual meetings who have had an affect on my career in different ways.

Is there anything else you would like to share with our readers?

Tribology and lubrication may not appear to be a sexy phenomenon such as the Internet or other high-tech discoveries, but they enable all the machinery without which our life would be very different and much more difficult. Cars, ships and space apparatuses, manufacturing equipment and processes for modern electronics and computers, as well as many other important aspects of our society infrastructure need our help in creating tribology products and services. I hope your readers appreciate and enjoy our field of tribology and lubrication. **<<**

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