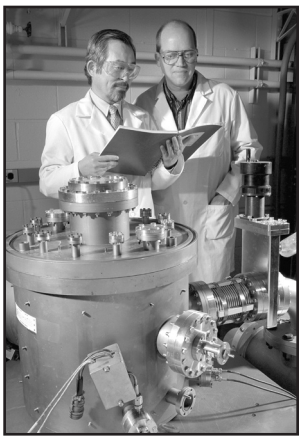
Technologies for Enhancing Thermal Conductivity and Reducing Friction

Fluids, coatings, and lubricants contribute to energy efficiency by reducing friction and enhancing thermal conductivity. Argonne National Laboratory currently has several projects underway to develop advanced fluids, films, coatings, and processes for next-generation transportation applications.

Nanofluids Increase Thermal Conductivity and Long-Term Stability

Metal nanofluids developed at Argonne offer superior heat transfer and suspension capabilities. Nanofluids can help to make equipment more energy-efficient by improving heat transfer and reducing component size so vehicles can become smaller and lighter. Argonne's one-step direct evaporation-condensation method produces metal nanofluids with non-agglomerating particles. These nanofluids have greater long-term stability and heat transfer capabilities (more than 10 times greater) than other available technologies.



Researchers confer near Argonne's one-step nanofluid production system, which produces highly conductive metal nanofluids.

For more information, go to www.techtransfer.anl.gov/techtour/nanofluids-summary.html or contact Jules Routbort at (630) 252-5065.

Laser Glazing Contributes to Fuel Efficiency and Rail Safety

Reducing the friction created by trains as they pass over steel rails helps improve rail safety and reduce fuel consumption. Argonne's laser glazing technique can reduce friction between rails and wheels by as much as 40%, and may mitigate rail fatigue. Laser glazing works by melting the surface of the rail using a laser, and letting the melted material solidify quickly to form a hard low-friction surface that reduces gage-face friction. The technique may be applicable to other steel surfaces such as bearings and gears.

For more information, go to http://www.transportation.anl.gov/research/materials/laser_glazing.html or contact George Fenske at (630) 252-5190.

Ultra Low-Friction Films Enhance Machining and Reduce Wear

As vehicle manufacturers seek to reduce the size zand weight of vehicles, the need for durable, lightweight materials increases. These materials must be able to tolerate surface friction, high temperatures, and hard-wearing environments. Argonne's smooth, wear-resistant, near-frictionless carbon films offer extremely low friction for both manufacturing and component applications. Laboratory studies have shown that these near-frictionless carbon films can be used on aluminum and titanium alloys as well as many plastics to produce vehicle parts offering low friction and high wear resistance. Argonne's near-frictionless carbon film technology won the Laboratory a prestigious R&D 100 Award in 1998.

For more information, go to http://www.transportation.anl.gov/research/materials/diamond_film.html or contact George Fenske at (630) 252-5190.

Boric Acid Lubricant Improves Cold-Forming Processes

Lightweight materials are finding use in many vehicle applications, and they might be used in even more, except for the fabrication challenges they present. Aluminum- and magnesium-based alloys are difficult to form under the high pressures exerted in metal-forming. Conventional lubricants are often unable to counter this friction effectively, and they can be flammable, toxic to process, and difficult to dispose of safely. Scientists at Argonne National Laboratory have discovered that boric acid offers excellent lubricant properties without the drawbacks associated with many conventional lubricants. Clean, non-toxic, plentiful, and safe, boric acid is a far less expensive and more efficient manufacturing lubricant for metal alloys.

For more information, go to http://www.transportation.anl.gov/research/materials/boric_acid.html or contact George Fenske at (630) 252-5190.