1987
Argonne is only national laboratory in the four-member National Science Foundation Center for Superconductor Applications.

1987
Argonne develops world's first flexible ceramic superconducting wire.

1989
Powerful ceramic superconductor created.

Faster than a Speeding Bullet

The flywheel doesn't fly like Superman, but it does spin — and fast. Argonne is testing flywheels that in the future will reach rim speeds greater than 2,000 miles an hour — faster than a speeding bullet, and about three times the speed of sound. The flywheel rotor is a rapidly spinning disk attached to a permanent magnet ring that floats above high-temperature superconducting material. The superconductor generates a magnetic field "cushion" when it is cooled to minus 321 degrees F (77 K). This cushion allows the flywheel rotor to hover above the superconductor without touching it. The entire assembly — a high speed rotor with this superconducting magnetic bearing combined with an efficient motor/generator — is called a Flywheel Energy Storage System.

Researchers from Argonne and Chicago's Commonwealth Edison utility are jointly developing the flywheel system. When the system lights a simple electric bulb, it illuminates the possibility of a future powered by superconductors. Argonne is developing a prototype system that will generate about one kilowatt hour of power, the equivalent of powering ten, 100-watt light bulbs for one hour.

Larger energy storage systems are planned. With further development, this system could dramatically change the way energy is produced and supplied to consumers. During the day the spinning flywheel would release energy to meet the increased demands of electricity, and at night, the disk would act as a storage system. It would provide a consistent stream of electricity, avoiding the usual peaks and valleys of electrical demand during a 24-hour period. Commonwealth Edison also plans to use the system as a backup energy supply during power outages.

Reduced frictional drag is the key to the efficiency of the flywheel energy storage system. The flywheel is contained in a vacuum chamber, to eliminate air friction. Because the magnetic bearing floats above the superconductor, frictional drag is one-tenth that of any conventional bearing system. Argonne continues to hold the world record for least friction created in a magnetic bearing. This low-friction system is under continuous improvement, using larger rotors, greater speeds and improved superconducting materials.

Roller-Coaster Electron Ride

New measurements demonstrate that electrons in high critical temperature superconducting materials behave like bonded "buddies" on an electrical roller-coaster ride. Using "photoemission" measurements that shoot photons at single superconducting crystals, Argonne researchers pinpointed exactly where electron pairs are broken and concluded that electron pairs rotate around each other along a pathway that takes them on high climbs and low dips. This roller-coaster movement makes electron pairs difficult to break up in some directions, and easy to tear apart in others. Their degree of "bondedness"