Superconductivity

Powering the Nation

Los Alamos is leading the way in research and development of practical uses for superconductivity, the ability of certain materials to carry electrical current with no resistance for increased efficiency and reduced cost. Los Alamos' Superconductivity Technology Center coordinates a multidisciplinary program of research, development and technology transfer in collaboration with American industry, universities and other national laboratories. Center partners are developing electric power and electronic device applications of high-temperature superconductors, those that take on superconducting properties at the relatively affordable temperatures that can be attained by liquid-nitrogen cooling.

Los Alamos scientists have produced a superconducting tape, a form of wire for high-current electrical transmission lines, that should be competitive in price within a decade. These superconducting tapes carry more than one million amperes of electric current for each square centimeter. Because superconductors can efficiently conduct so much more current than copper or aluminum wires, they will more effectively distribute power supplies based on demand.

Los Alamos' partners in development of second-generation tapes and their electric power applications include American Superconductor Corp., Intermagnetics General Corp., SuperPower, Hypertech, General Electric, duPont and Oxford, along with several national laboratories and universities.

Examples of potential commercial products are transmission lines, industrial motors, fault-current limiters, generators, transformers, flywheels, magnetic energy storage and cleanup of environmental pollutants by magnetic separation. Superconductors are already widely used in magnetic resonance imaging, a noninvasive medical technique for seeing inside the body to diagnose injuries, detect tumors, and diagnose diseases that change human anatomy. In the future, superconductors could be used for magnetic levitating trains that will travel at more than 300 miles per hour, for all-electric ships, to map neural pathways in the brain and to image the heart.

Los Alamos' international leadership in basic research on superconductivity provides the foundation for these technical advances. Applied research and development efforts include powder synthesis, processing of tapes and coils, deposition of thin and thick films, characterization of microstructural and superconducting properties, power cryogenic engineering and fabrication of prototype devices.

Los Alamos is part of the U.S. Department of Energy's Superconductivity Partnership Initiative and Superconductivity Program for Electric Systems. Los Alamos has established a wide range of collaborations that are accelerating the day when these superconductor applications will become commercially available. These technology advancements will dramatically improve U.S. energy efficiency and international competitiveness.

Los Alamos has pioneered the manufacture of superconducting tapes in industrial lengths.

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