

Superconductors for electrical, defense, space, medical applications

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A Wright State engineering professor Sharmila Mukhopadhyay recently received a \$950,000 grant for superconductor research with applications that interest the electric power generation industry, the military, space technologists and the medical community.

“[Superconductors](#) can transmit electric current with zero resistance,” she explained, “and our research is centered on finding ways to make these materials more efficient and economical.” She said copper wire is the main conductor now in use, but transmission lines can carry significantly more power if copper can be replaced by superconducting cables. The superconducting material of choice is an oxide of yttrium, barium and copper that will be coated on metal coils.

Sharmila Mukhopadhyay, Ph.D., a professor of materials science and engineering with the Wright State College of Engineering and Computer Science, received funding from the U.S. Department of Energy for the 18-month project.

Mukhopadhyay, who has received \$2.3 million for materials research at Wright State during the past seven years, said the energy department and power generation companies have a renewed interest in superconductor research. “We are studying the superconducting materials at their basic, atomic level to identify ways that can increase the efficiency of transmission lines. Superconductors can also be used in high speed magnetic trains and flywheels. Flywheels, or high speed rotating devices, can help the power generation companies store off-peak power, which can later be converted to electricity during peak demand hours. All this

technology can help reduce the chances of power blackouts like the major one that hit the Midwest and East Coast last year.”

She said superconductor research in recent years is becoming more popular. “The earlier superconductors used liquid helium as the cooling medium, but the recent ones can use liquid nitrogen, which is much cheaper,” she explained.

The WSU research engineer is working with the Air Force Research Laboratory at Wright-Patterson Air Force Base in Dayton on military applications. The superconductors can improve the electrical system efficiency in jet engines for fighter bombers and transport aircraft because they are lighter and smaller than regular conducting devices. She said that the Air Force’s objective is to provide megawatts of power in small, lightweight packages. Weapons applications include missile development because superconductors operate at higher temperatures with substantial weight savings and lower cooling requirements.

Space related organizations will also be interested, she added, because the research involves finding more efficient power generation in air and space for projects involving spacecraft, satellite orbit transfer vehicles and reusable space launch vehicles.

The research engineer, whose training includes materials science at Cornell University and solid state physics at the Indian Institute of Technology, said medical applications include use in MRI machines and other magnetic medical devices.

Mukhopadhyay is the principal investigator on the project, which also involves the State University of New York at Albany in addition to the Air Force Research Lab.

Source: Wright State University

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