# SUPERCONDUCTIVE MATERIALS

Superconductivity holds great promise for the future – especially in the area of energy efficiency. Briefly, superconductivity is the physical phenomena of a flow of electricity that has zero resistance. A superconducting current loop can flow indefinitely without an external power source to maintain it.

Because of the unique physical properties of a superconducting circuit, many advanced and important applications have been developed, including magnetic levitation trains, Magnetic Resonance Imagery (MRI), powerful electromagnets, magnetometers and other advanced applications. Future applications are also proposed in the areas of power storage, transformers, motors, and transportation, where reduced energy usage is envisioned as a key benefit to be obtained from superconductive technology.

Several difficulties exist for applications of superconductive materials that has limited their use. One difficulty is that the property of superconductivity normally only exists at very cold temperatures. Until 1986, physicists believed that the maximum temperature that superconductivity could exist was at a temperature below minus 400 degrees Fahrenheit. Such ultra-cold temperatures are expensive to produce and maintain. Another difficulty is that the theory of superconductivity is incomplete, leaving physicists and engineers at a great disadvantage in trying to find and develop applications for superconductivity.

Researchers have discovered materials that will superconduct at temperatures much higher than minus 400 degrees F. **Superconductivity at temperatures as high as minus 244 degrees F have been developed at the University of Arkansas.** It is economically important that the temperature of superconductivity (critical temperature) be above minus 321 degrees F as that is the boiling temperature of liquid nitrogen. Liquid nitrogen is less expensive to produce than other substances such as liquid helium.

The discovery and characterization of high temperature superconducting materials is also important because the theory of superconductivity at the higher temperatures is incomplete, and the use of these new high-temperature superconducting materials may lead to better understanding of the underlying physical phenomena. One problem for high temperature superconducting materials is that most of the materials are ceramics that cannot be formed into wires that can then be used in practical applications. However, **meltable high-temperature superconducting materials have been produced that have critical temperatures at about minus 310 degrees F. Also, superconducting films have been developed.**

A group of five patents that cover the superconductivity technology, materials and methods of making, are available for license.

For more information: Mark Swaney
mailto:officeremail@uark.edu or 479-575-7243
http://www.uark.edu/ua/techip
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