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Licensable Technologies

Ultraconductus: A revolutionary electrical transmission material

Applications:

- High-speed communications
- Computing
- Biological sensors
- Medical instrumentation and treatment
- Low-cost purification
- Energy storage
- Communication
- Sensors

Benefits:

Transformative technology:

- Less expensive materials
- Lighter, stronger materials
- Eliminates connectors
- Increased conductivity
- Storage of electricity

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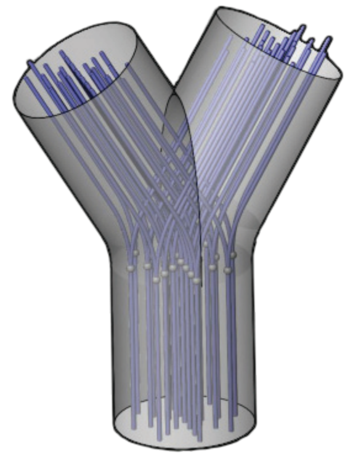
Summary:

The electrical grid in the United States loses approximately 8% of its energy during transmission and distribution for a variety of reasons. Increasing the efficiency of electrical transmission has long been a goal of energy conservation research. Opportunities to reduce costs include: 1) using less expensive conductive materials; 2) improving the conductivity of materials that transmit electricity; 3) reducing the weight of the transmission lines, which would reduce the weight and cost of the supporting infrastructure; and 4) improving the efficiency of the many connectors required in the country's electrical grid. Los Alamos National Laboratory (LANL) is currently researching an engineering and scientific breakthrough called Ultraconductus, which goes a long way toward adopting and integrating the above approaches into a single solution.



Branching without connectors is one unique feature of Ultraconductus cable.

Ultraconductus is a revolutionary, disruptive technology created by growing long-length metallic carbon nanotubes (CNTs) while simultaneously cladding them within a metal matrix. As a result of this process, electrical current can jump between and along the ends of the metallic CNTs, thereby increasing the net electrical conductivity of the metal matrix by at least 100 times. Ultraconductus also makes it possible to grow electrical cable harnesses for specific applications that have branching junctions such as built-in Y-adaptors, eliminating the need for external connectors (see figure). The Ultraconductus wires have a greater tensile strength than steel, more than 10 times the tensile strength and up to 100 times the conductivity of copper, and operate at room temperatures and higher. The wires do not require cooling, unlike superconductors, and have fewer physical limitations that lead to power loss.

The Ultraconductus manufacturing process begins when a primary set of laser beams is focused on a pressurized chamber containing a retractable mandrel coated with catalytic nanoparticles. Hydrogen and an appropriate hydrocarbon then flow through a nozzle onto the laser foci, where vertically aligned CNTs are grown into the laser beams. If the beams remain stationary, CNTs will grow into their respective beams along the laser axis. When the focused laser spots are drawn backwards, the CNTs follow, thus yielding long strands of material. In each laser focus there are millions of CNT strands. By embedding CNTs in a metal matrix, ballistic transport occurs within the nanotubes, thus increasing the net electrical conductivity of the nanocomposite.

Replacing even one-half of the high-voltage cables in the U.S. with products made from Ultraconductus would yield annual energy savings of approximately 150 billion kilowatt hours, which translates to cost savings of approximately $15 billion each year.

Development Stage: Prototype

Patent Status: Patent pending

Licensing Status: Los Alamos National Laboratory is seeking partners interested in joint collaborative and/or exclusive or nonexclusive licensing opportunities.

www.lanl.gov/partnerships/license/technologies/

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