TIP Project Brief – 090045/10H004

Manufacturing
High-Speed, Continuous Manufacturing of Nano-Doped Magnesium Diboride Superconductors for Next-Generation MRI Systems

Develop a practical, industrial scale continuous manufacturing process for magnesium diboride superconducting wires and other wire products requiring a hollow metal tube around a powder-based core.

Sponsor: Hyper Tech Research, Inc
Columbus, OH

- Project Performance Period: 2/1/2010 - 1/31/2013
- Total project (est.): $6,050 K
- Requested TIP funds: $3,000 K

Hyper Tech Research, Inc., is attempting to develop an industrial-scale process for the continuous manufacture of superconducting wires using a relatively new high-temperature superconductor, magnesium diboride. A relatively simple metallic compound, magnesium diboride becomes superconducting below 39 degrees Kelvin, one of the higher transition temperatures for known metallic superconductors. In practice this means that--unlike ordinary metal wire-present day superconducting wires currently used in MRI's are manufactured using a relatively expensive and labor-intensive batch process, which limits the maximum possible length of a single wire, thus the desire for a continuous manufacturing process to reduce manufacturing costs, and increase piece lengths. Since magnesium diboride superconductor starts out as a powder mixture, the powder will be placed in a continuous formed and filled tube with an outer metallic sheath such as iron or niobium, to distribute the powder along the wire. Then several monofilament wires will then be continuously restacked into another copper or copper-nickel formed tube to manufacture a multifilament superconductor wire. Hyper Tech Research, which has been working on improving the performance of magnesium diboride superconductors using nanopowder additives, is scaling up an experimental Continuous Tube Forming and Filling Process (CTFF) to convert magnesium diboride wire from batch processing to high-speed, continuous manufacturing, demonstrating uniform mixing of nano-sized additives and micro-sized powders, continuously monitoring and dispensing the powders at high speeds, and demonstrating process modeling and adaptive control for both monofilament and multifilament wires. The scientific and technical research program falls across several disciplines: superconductors, metal forming, laser welding, process modeling, adaptive controls, sensors and the uniform mixing and dispensing of nano and micron powders. If successful, the project will enable relatively low-cost high-temperature superconducting wires for magnetic resonance imaging (MRI) and electric power applications, but the basic technology will have application in the production of flux-cored welding wire, specialty alloys and the small diameter tubing market as well.

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