Cabling Method of HTS Flat Tape Superconducting Wires
Technology #13179

Applications

Superconducting wires are used for power transmission cables, magnet conductors, data server centers, power distribution in microgrids, and power transmissions from alternative energy sources.

Problem Addressed

Existing superconducting wires can increase their capacity with a parallel arrangement of the wires. However, there is a significant amount of heat loss caused by resistive and magnetic hysteresis generated by flux couplings in the loop circuits among the superconducting wires. By twisting the superconducting wires, the magnetic flux coupling is heavily reduced. There exists a demand for high current capacities in both AC and DC applications that current technologies are not capable of sustaining. Therefore, the high current capacities of the High Temperature Superconductors (HTS) needed for practical applications can be acquired with the removal of accompanying AC losses or magnetic flux coupling losses.

Technology

The basic cable has a plurality of flat, tape-shaped ribbon superconductor wires assembled to form a stack having a rectangular cross section. The stack has a twist about the longitudinal axis of the stack. The wires are ReBCO (YBCO, GdBCO), BSCCO, or MgB_2 tape conductors. The basic cables can be twisted together to form a larger cable that transmits higher electric current. The twisting is important in order to reduce undesired magnetic flux coupling between superconducting wires as well as to increase mechanical bendability. The superconducting cable is disposed within and spaced apart from an electrical insulator, and the space between the cable and the insulator provides a channel for coolant. A cryostat surrounds the insulator to create a return coolant channel for thermal insulation.

Advantages

- Adaptability in both AC and DC applications over wide ranges of current and voltage
- Significantly higher current density of power cables and magnet conductors, even for very high magnetic fields
- Increases mechanical strength of the superconductor
- Obtains better thermal cooling

Categories For This Invention:

- Electronics & Circuits
- Semiconductors & Integrated Circuits
- Energy
- Energy Efficiency
Power Plants

**Intellectual Property:**

Superconductor Cable
Issued US Patent
8,437,819

**Inventors:**

Makoto Takayasu
Joseph Minervini
Leslie Bromberg

**Publications:**

- Present Status and Recent Developments of Twisted Stacked-Tape Cable (TSTC) Conductor
- Low-Field-Orientation Effect On REBCO Tape Performance And Its Power Cable Application
  IEEE Transactions on Applied Superconductivity
- Investigation of REBCO Twisted Stacked-Tape Cable Conductor Performance
  Journal of Physics: Conference Series
- Conductor Characterization of YBCO Twisted Stacked-Tape Cables
  IEEE Transactions on Applied Superconductivity
- HTS Twisted Stacked-Tape Cable Conductor
  Superconductor Science & Technology
  Vol. 25, No. 1, January 2012
- Investigation Of Twisted Stacked-Tape Cable Conductor
  AIP Conference Proceedings
  Vol. 1435, p 273-80, 2012
- Cabling Method for High Current Conductors Made of HTS Tapes
  IEEE Transactions on Applied Superconductivity
- Torsion Strain Effects On Critical Currents Of HTS Superconducting Tapes
  IEEE/CSC & ESAS European Superconductivity News Forum (ESNF)
  No. 10, October 2009
- Cabling Method for High Current Conductors Made of HTS Tapes
  IEEE Transactions on Applied Superconductivity
- Torsion Strain Effects On Critical Currents Of HTS Superconducting Tapes
  IEEE/CSC & ESAS European Superconductivity News Forum (ESNF)
  No. 10, October 2009
External Links:
Plasma Science and Fusion Center
http://www.psfc.mit.edu/

Image Gallery: