

Demonstration of Persistent Mode Superconducting Coil Fabricated by Wind-and-Flip Technique using Coated Conductor

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Motivation

- There has been a lot of progress in coated conductor technology (>70,000 A-m) and ready to use for application in the near future.
- Superconductive joining is needed in order to utilize coated conductor for the application of NMR, MRI, magnetic separation magnets
- Jointing technique of YBCO coated conductor, which is a prerequisite for achieving a persistent current, has not been developed yet
- Design of persistent mode magnet by wind-and-flip technique of coated conductor has been suggested (Physica C, in press)
- It is valuable to demonstrate a persistent mode HTS magnet utilizing coated conductor

Construction and Testing of pancake coils

Coil dimension

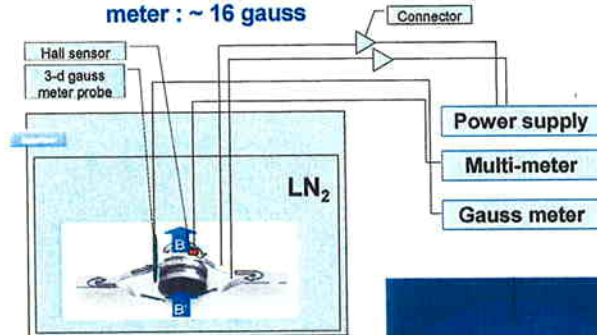
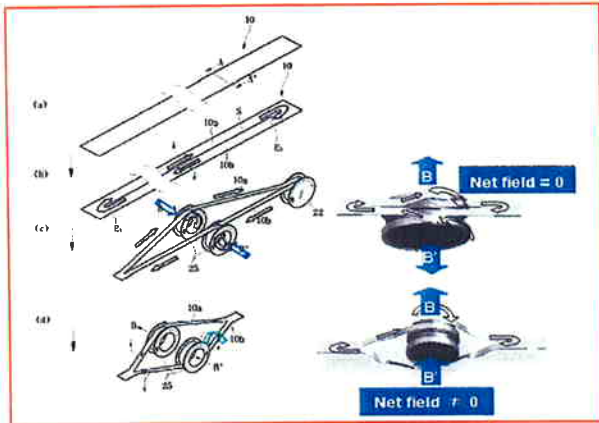
- Diameter : 40 mm
- Total height : 18 mm, tape width : 6 mm, thickness 0.2 mm
- # of turns/coil : 8, total 16 turn
- Tape length used : 1.2 meter



Test

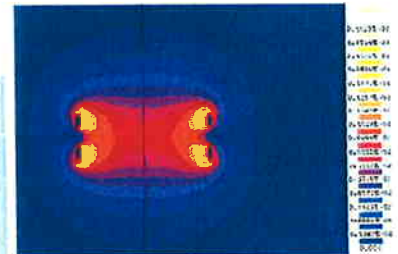
- Applied current : 20A
- Measured field intensity : 48.8 gauss by Hall sensor
- Calculated magnetic field intensity : 52 gauss
- Measured field intensity at the side by gauss meter : ~ 16 gauss

Wind-and Flip technique for persistent mode magnet using closed loop coated conductor



Calculation of flux density for the magnet @ 20 A

The difference in magnetic field intensity between calculated (52.3 Gauss) and measured by hall sensor (48.8 Gauss) might be due to the mismatch of Hall sensor position for measuring.



Slitting of coated conductor tape

- Slitting with diamond blade
- Protective coating with Silicone base cryo epoxy
- Insulation between turns : Kapton tape



Super current had been maintained with no magnetic field degradation for 72 hr

Future works:

- Demonstration of stacking multiple coils
- Fabrication of double solenoid coils
- Compact coil structure for application.
- Practical design of superconducting switch

Conclusion

- Persistent mode magnet has been demonstrated utilizing slit coated conductor
- There was little difference in magnetic field intensity between measured and calculated one
- Super current had been maintained without magnetic field degradation for 72 hr