Poster No. 3LP4-07

Improvement of Magnetic Field Homogeneity from the HTS Joint-less Coil

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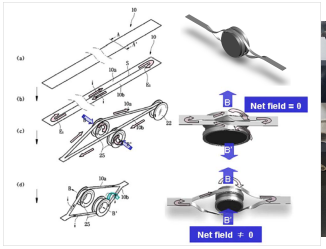
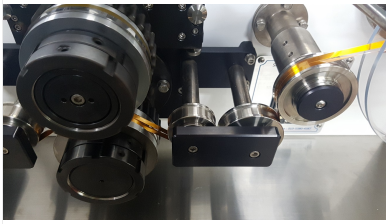
I. Introduction

- We proposed a solenoid type HTS magnet without any joints by using the joint-less winding technic with 2G HTS wide tape conductor.
- The joint-less winding technic requires a long piece of HTS wide tape with high critical current, so we prepared an HTS tape with a width of 12-mm and a length of 50-m.
- We tried to charge the coil up to the central field of 1.1 T with spatial homogeneity of 10 ppm by the field-cooling process with another HTS 3-T background magnet.

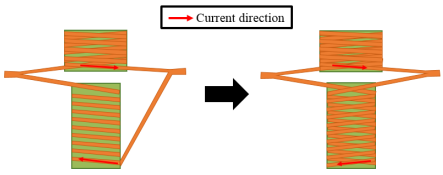
II. Joint-less Solenoid HTS Coil winding method

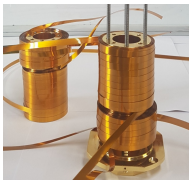


[Concept of the Joint-less Winding]



[Cutting process for Joint-less winding]

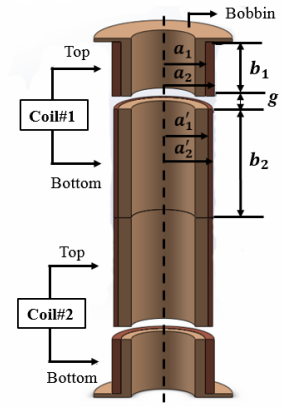




[Half of the proposed Solenoid Joint-less Coil]

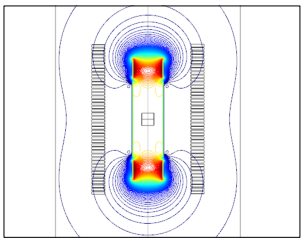
- In order to improve the homogeneity of the center magnet flux density, two of the identical joint-less coils were prepared and arranged them symmetrically, so that we could avoid unfavorable gap near the magnetic center of the solenoid coil.
- If we go for the solenoid winding instead of the pancake winding, the number of turns for each coil is easy to be controlled so that it can have the advantage of improvement of magnetic field homogeneity.

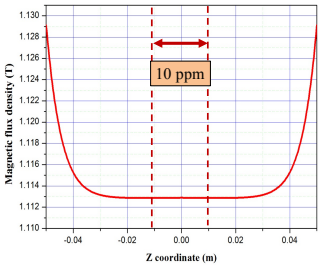
III. Design of Joint-less Solenoid Coil



[Specification of the Solenoid Joint-less Coil]

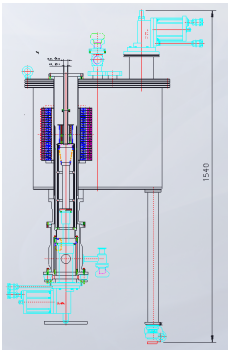
Parameter			Value
a_1			22.5 mm
a_2			27.3 mm
a'_1			24 mm
a'_2			26.4 mm
g			7 mm
b_1			30 mm
b_2			60 mm
No. of turns	Coil #1	top	5 layers X 30 turns = 150 turns
		bottom	10 layers X 15 turns = 150 turns
	Coil #2	top	10 layers X 15 turns = 150 turns
		bottom	5 layers X 30 turns = 150 turns
	total		600 turns
Length of wire	12 mm width		47.217 m
Operation current			360 A @ 20 K
Center field			1.1128 T



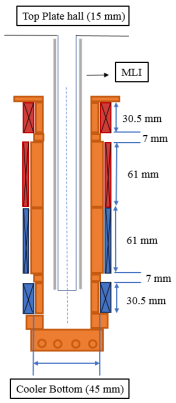


[FEM analysis of the magnetic flux density of the coil, DSV 20 mm]

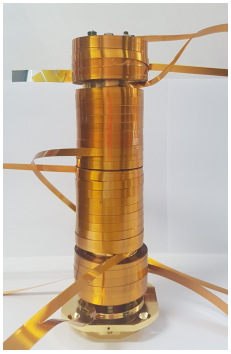
IV. Installation of a Joint-less HTS Solenoid Coil for Field Cooling



[System drawings]

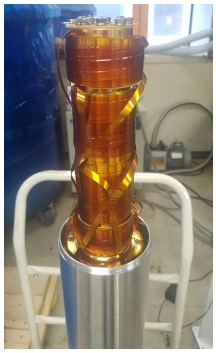


[Installation of the Joint-less coil]

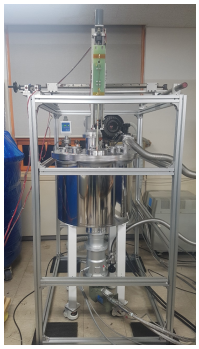


[Fabricated Joint-less coil]

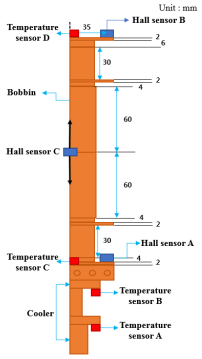
V. Estimation and Experimental Results



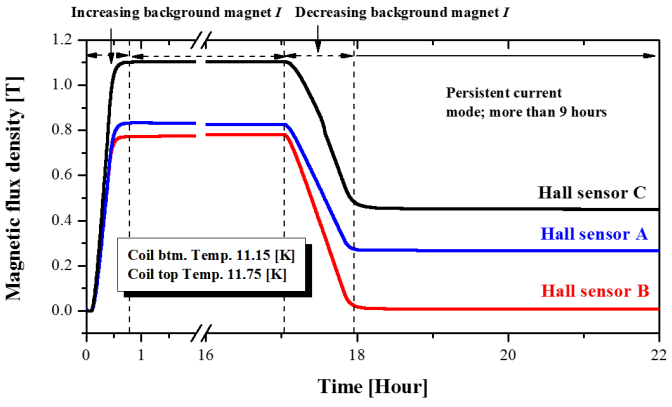
[Installation of the Coil]



[Experimental setup with field mapper]



[Location of each sensors]



[Measured magnetic flux densities according to the elapsed time]

VI. Conclusion

- A solenoid type joint-less HTS coil composed of two separated HTS coils was proposed, and a prototype design of the coil was designed and fabricated.
- The fabricated HTS coil has been cooled down by the conduction cooling and charged up by the field cooling with another HTS background magnet.
- During the experiment, one of the two separated coil, upper coil, was found not working properly, while the other coil, lower one, looks well working as expected.
- The upper coil was suspected of being damaged by handling or winding process. We are now trying to replace the damaged coil with a new one, and continue the experiment in order to show the feasibility of this joint-less coil as a part of the high field magnet.