

nTMM magnets construction

1. Report on degaussing and field measurement at UKY (Chris)
2. Measurement of the coil resistance: is it 25 ohm? (Chris)
(see calculations in Gianna Rotellini report ~ 40 ohm
https://web.utk.edu/~kamyshko/UT_nn'_group/2024/04/11/GR_Magnet_Calculations.pdf)
3. Discussion of insulation layer between copper wires and mu-metal shield to prevent short circuit (Yuri)
4. Update on the wire winding preparation for the magnet 1 at UKY (Chris)
5. Scheme of degaussing of mu-metal shield of the final magnets. (Chris)
How often the degaussing should be performed?
Degaussing in-situ before/during experiment?

Graphite foil

Chemical composition: carbon (C), ash 0.5%

Property	Value in metric unit		Value in US unit	
Bulk density	0.5-1.1*10 ³	kg/m ³	31-69	lb/ft ³
Thickness	0.2-1.0	mm	8-40*10 ⁻³	inch
Permeability	1.3*10 ⁻¹⁰	m ² /s	2*10 ⁻⁷	in ² /s
Tensile strength	5.1	MPa	740	psi
Compression rate	47	%	47	%
Recovery rate	15	%	15	%
Stress release rate	1.0	%	1.0	%
Thermal expansion PS	5*10 ⁻⁶	°C ⁻¹	2.8*10 ⁻⁶	in/(in* °F)
Thermal expansion AS	200*10 ⁻⁶	°C ⁻¹	111*10 ⁻⁶	in/(in* °F)
Thermal conductivity PS	200	W/(m*K)	1400	BTU*in/(hr*ft ² *°F)
Thermal conductivity AS	5	W/(m*K)	35	BTU*in/(hr*ft ² *°F)
Electric resistivity PS	7*10 ⁻⁶	Ohm*m	7*10 ⁻⁴	Ohm*cm
Electric resistivity AS	1000*10 ⁻⁶	Ohm*m	1000*10 ⁻⁴	Ohm*cm
Work temperature	200-3200	°C	390-5790	°F
Oxidation temperature	850	°C	1562	°F

PS - parallel to the surface

AS - across the surface

$$\text{Heat flux } q [W/m^2] = -k\nabla T$$

k– thermal conductivity

Copper	~ 400 W/m·K
μ-metal	19 W/m·K
Graphite foil	5 W/ m·K
Teflon	0.3 W/ m·K

nTMM magnets prototype test (work with Vacuum vessel)

1. Install vacuum vessel supports on the table (Isaiah have them)
2. Mount vacuum vessel on the table (Sean)
3. Finish sealing unused ports (Shaun)
4. Install vacuum gauge (Leah has it?)
5. Install vacuum hose and pump (do we have them?)
6. Install port with connector for magnet current [for 30 Gauss test $V=57V$, current 1.43 A]
7. Connect to UT power supply [not to exceed 100 V, 3 A]
8. Install vessel flange connector with 8 thermocouples connected to Data Logger
9. Fix Data Logger to the Vessel close to flange feedthrough (<0.5 m)
10. Current and thermocouple pins from outside the vessel should be soldered and isolated by thermal-shrink tubes
11. Current and thermocouple wires (~ 2.5 m length with sensing tips) inside the vessel to be permanently soldered to feedthrough flanges and covered by thermal-shrink tubes
12. Close the vessel flanges, seal all ports and test vessel for vacuum.

nTMM magnets prototype test (work with prototype magnet)

1. Remove black cover on both ends
2. Add one Worm-Drive Clump around the mu-shield
3. Measure resistance of the coil
4. With big end-flanges open move the prototype to the vacuum vessel on plastic shoes
5. Connect current power leads to the magnet coil
6. Install 8 thermocouples inside the Al tube and outside mu-metal (during insertion)
7. Fix tips of thermocouple with copper metal sticky tape.
8. Measure 3D magnetic field at the axis in the middle of magnet at reduced current .
Record current corresponding to 5 Gauss or 10 Gauss field (or 30 Gauss – depending on available magnetometer)
9. Test system at “30 Gauss” current **without** vacuum
10. Close end-flanges.
11. Test system at “30 Gauss” current **with** vacuum
12. 70 W power should be provided as test (in case of short circuit present)
13. Thermocouple data should be recorded in the Data Logger (Shaun)