

Overview of parameters used in structural FEM simulations for the 16T magnets

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Materials and Conditions as agreed

MATERIAL	σ_{VM} (MPa)		σ_1 (MPa), 4K	E (GPa)		Poisson	CTE
	293 K	4,2 K		293 K	4,2 K		
Coil	150	200	-	$E_x = 52$ $E_y = 44$ $G_{xy} = 21$	$E_x = 52$ $E_y = 44$ $G_{xy} = 21$	0,3	X = 3,1E-3 Y = 3,4E-3
316LN St. Steel	350	1050	-	193	210	0,28	2,80E-03
Al7075	480	690	-	70	79	0,3	4,20E-03
Iron (Ferromag)	180	720	380	213	224	0,28	2,00E-03
Ti6Al4V	800	1650	-	115	126	0,3	1,70E-03

Supporting structure and same conditions checked up to 105% of magnetic loads

Frictional coefficient for FEM analysis: 0,2

Limit stress values in the table are considered maximum for first design, and linear+elastic behavior up to it

Plane Stress conditions for 2D first designs

Coil properties in the table are considered perfectly homogeneous in the whole block for this first stage

Materials and Conditions as agreed

Remark on the stress limits

MATERIAL	σ_{VM} (MPa)		σ_Y (MPa)	σ_1 (MPa), 4K	E (GPa)		Poisson	CTE
	293 K	4,2 K	4,2 K		293 K	4,2 K		Integ (293 K to 4,2 K)
Coil	150	200		-	$E_x = 52$ $E_y = 44$ $G_{xy} = 21$	$E_x = 52$ $E_y = 44$ $G_{xy} = 21$	0,3	X = 3,1E-3 Y = 3,4E-3
316LN St. Steel	350	1050	600	-	193	210	0,28	2,80E-03
Al7075	480	690	400	-	70	79	0,3	4,20E-03
Iron (Ferromag)	180	720	700	380	213	224	0,28	2,00E-03
Ti6Al4V	800	1650		-	115	126	0,3	1,70E-03

*These are typical values for yield stress
So, in some materials plastic strains can be reached*

Added materials, updates,...

New information available point out the need of a deep investigation on coil properties

MATERIAL	σ_{VM} (MPa)		σ_1 (MPa), 4K	E (GPa)		Poisson	CTE
	293 K	4,2 K		293 K	4,2 K		
Coil	150	200	-	$E_x = 52$ $E_y = 44$ $G_{xy} = 21$	$E_x = 52$ $E_y = 44$ $G_{xy} = 21$	0,3	X = 3,1E-3 Y = 3,4E-3
316LN St. Steel	350	1050	-	193	210	0,28	2,80E-03
Al7075	480	690	-	70	79	0,3	4,20E-03
Iron (Ferromag)	180	720	380	213	224	0,28	2,00E-03
Ti6Al4V	800	1650	-	115	126	0,3	1,70E-03

These numbers could be risky because degradation...
maybe a value around 175 MPa should be used at cold.

This should to be perfectly defined and then the table updated.

Added materials, updates,...

These are some typical values for the lately added materials involved in the designs, but at this moment no official agreement was set on their properties

MATERIAL	σ_{VM} (MPa)		σ_1 (MPa)	E (GPa)		Poisson	CTE
	293 K	4,2 K		293 K	4,2 K		
Invar	670	1400	-	193	210	0,28	4,00E-04
Copper	170	450	-	130	130	0,3	3,20E-03
G10	400	750	-	Ex = 28 Ey = 22 Gxy = 10	Ex = 35 Ey = 26 Gxy = 12	0,15	7,00E-03

This could be a proposal, but it is open to fix the same numbers for everyone



Conclusion

- Material properties and main FEM parameters related to structural simulations in the scope of this project have been summarized.
- Data being used which is not included in the *official* table have been reported. Agreement on the values is needed