Superconducting magnets

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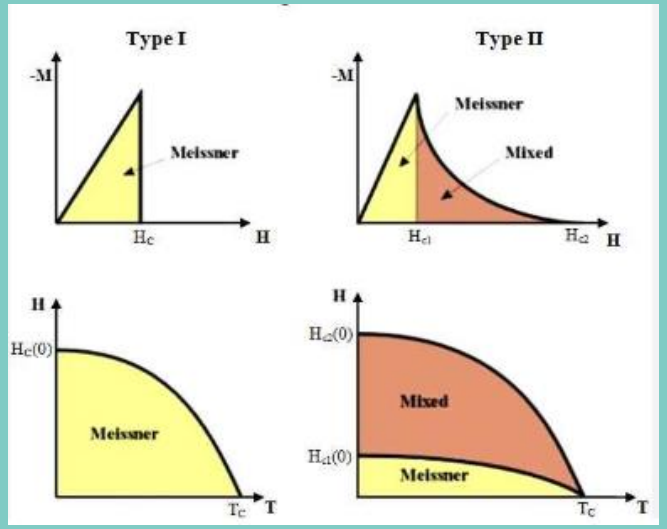
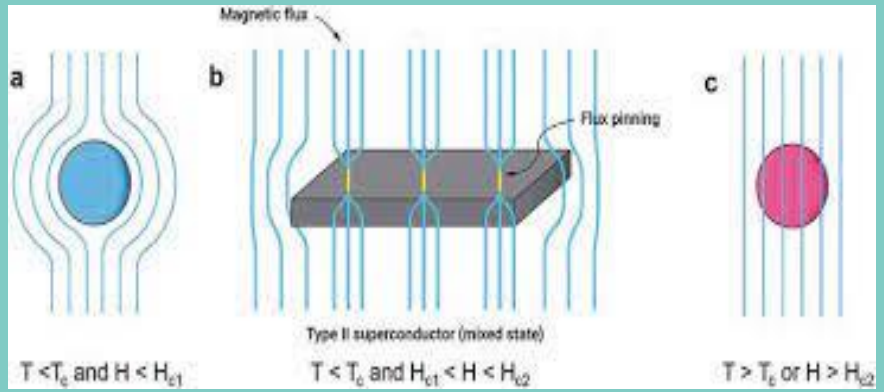
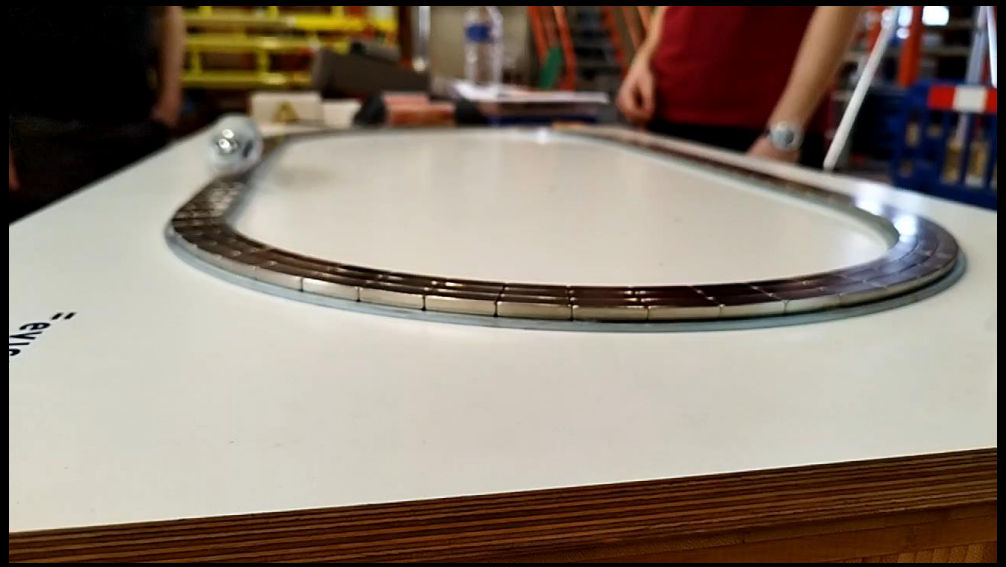
Introduction

1. Superconductivity (zero resistance)
2. Meissner effect
3. Type I and Type II superconductors
4. Mixed state (vortexes)



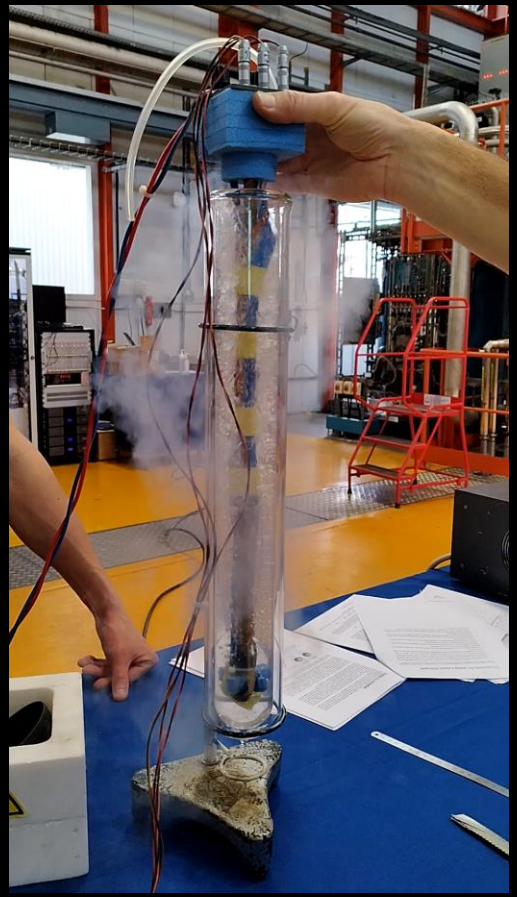


Levitation

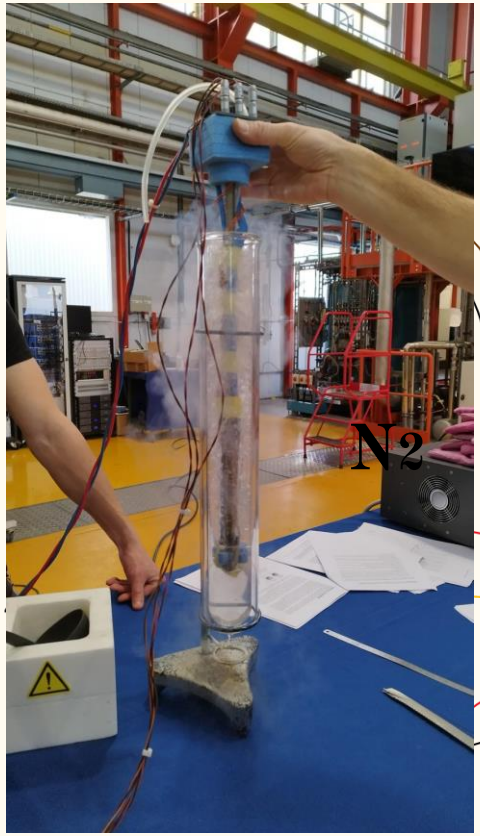


- Permanent magnet above superconducting
- Cooling with liquid nitrogen
- Levitation effect
- Measuring the temperature with Pt100 sensor when the field is lost
- 93 K

Electrical resistance



Resistivity

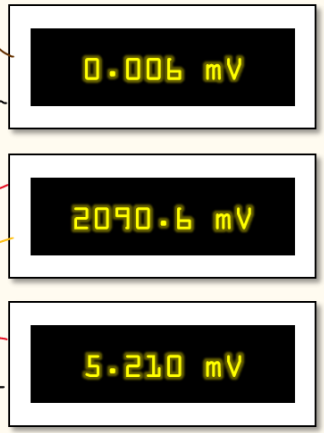


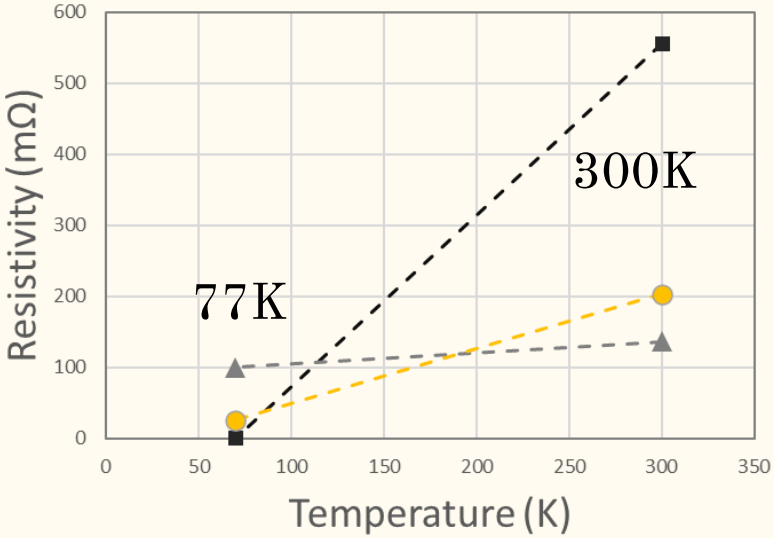
STEEL

COPPER (x100)

BCCO (x100)

@2A

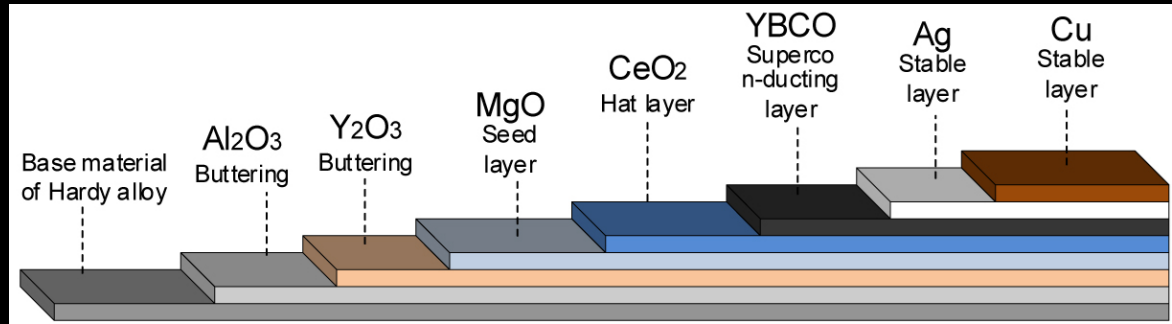




Normal conductor
When the Current increase the metal become to boiling.

Superconductor
At certain temperature decrease the resistance.

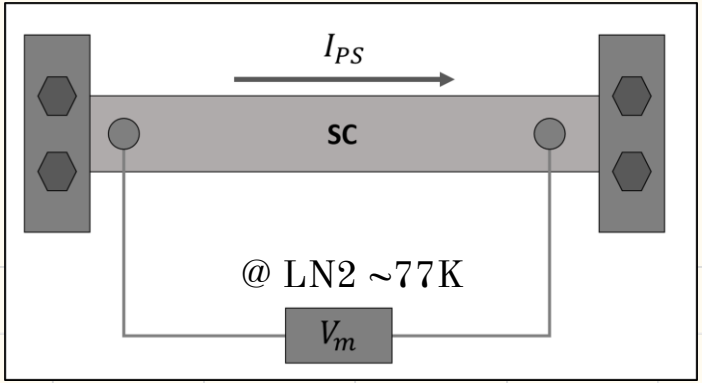
HTS Characterization

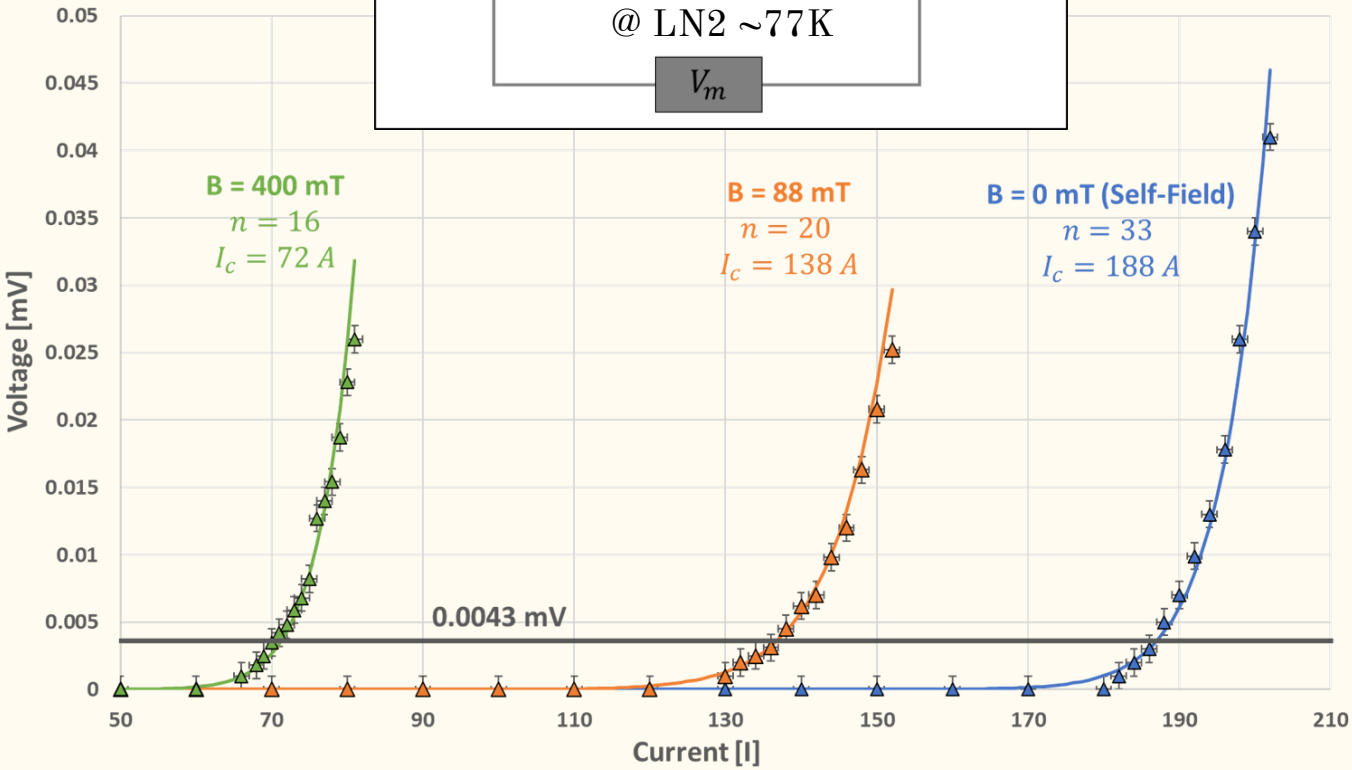


Characterization - Ic

1. HTS (YBCO) @ 77K
2. Critical Electric Field Criterion
   a. 1 uV/cm = 0.0043 mV
3. Material specific
   a. Fitting n ~23

$$E = E_c \left(\frac{I}{I_c} \right)^n$$



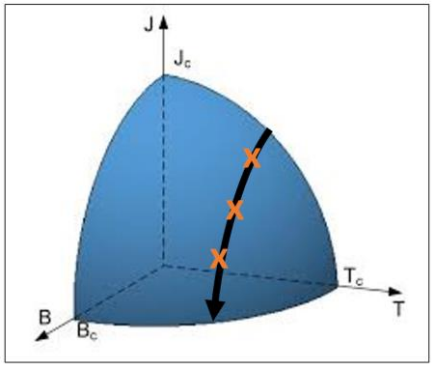


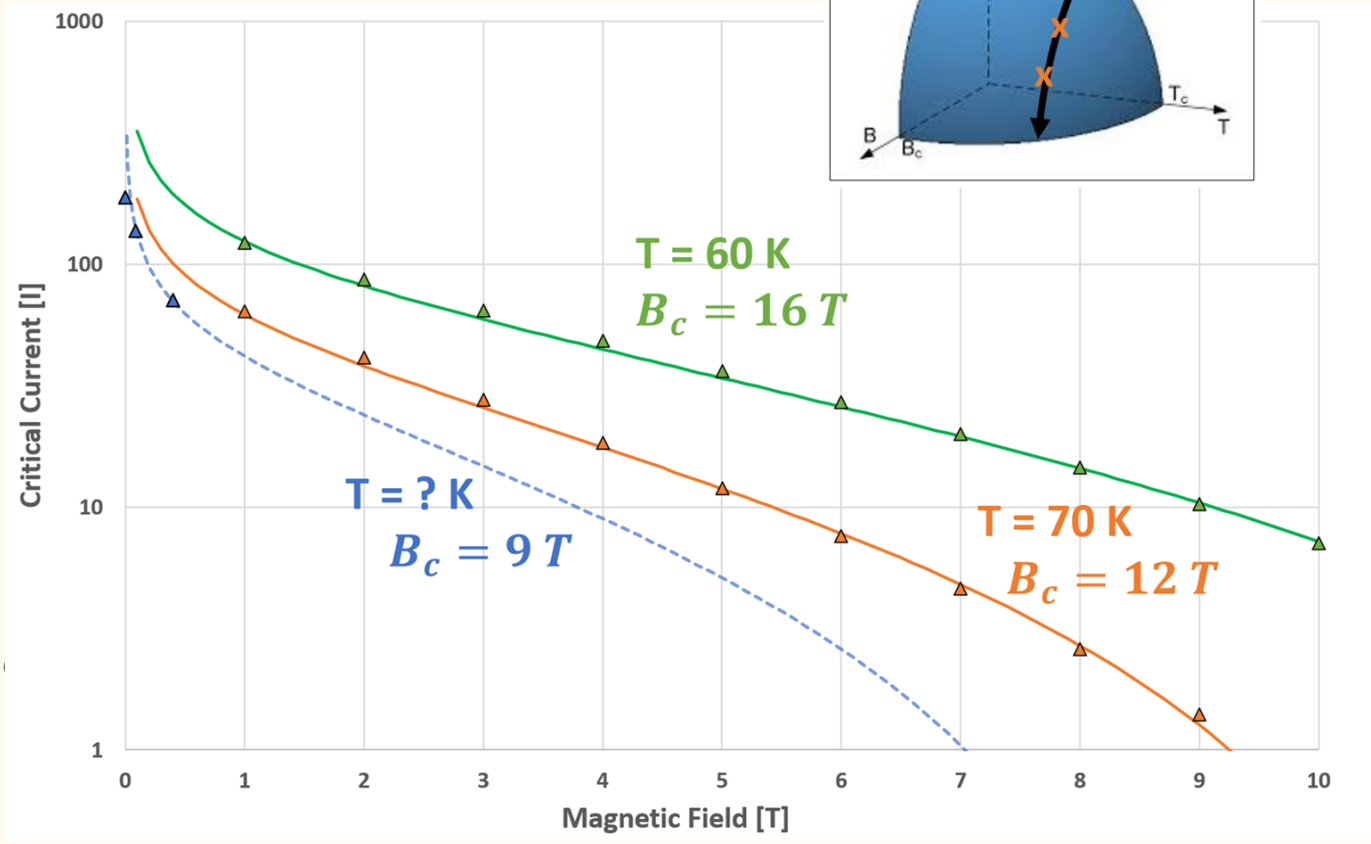
Characterization- B dependence

1. Magnetic Field Dependence
2. Probe part of critical surface at T~constant
3. Temperature difference might cause measurement to deviate.

$$I_c(B) = \frac{A}{B} b^p (1-b)$$

$$b = \frac{B}{B_c}$$





Conclusion

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- Meissner effect and pinning flux has been observed.
- Several measurements has been taken:
  1) Critical Temperature: 93K (YBCO)
  2) Resistivity BCCO @77K @ 2A: 0.35 μΩ
  3) Critical resistant YBCO @ 77K
     a) Ic = 188A @ 0 mT;
     b) Ic = 138A @ 88 mT;
     c) Ic = 72 A @ 472 mT;

B ⬆ → Ic ⬇