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Nb₃Sn and NbTiN progress towards Cavity coating

14th IFAST WP9 Quarterly Meeting



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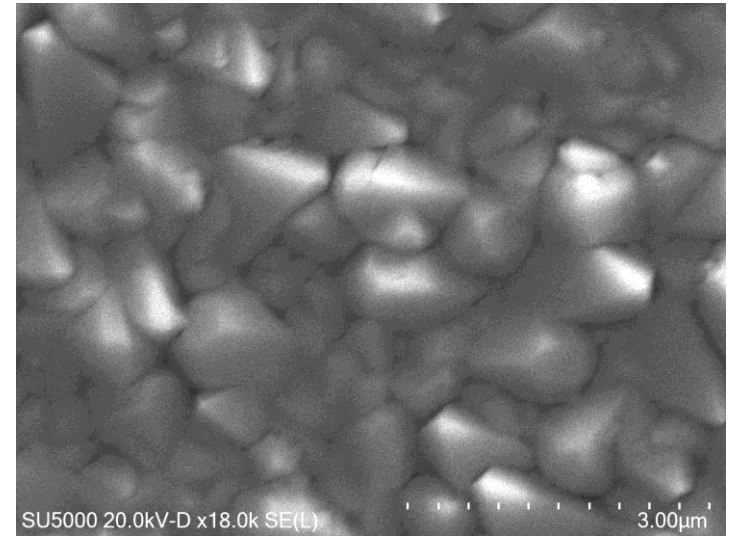
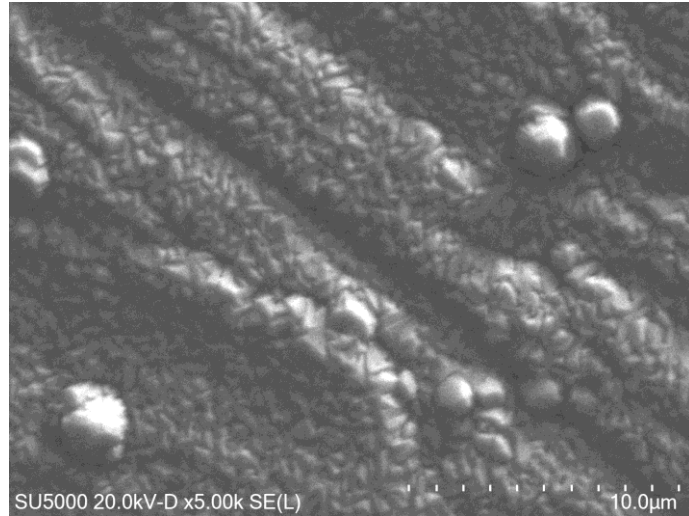
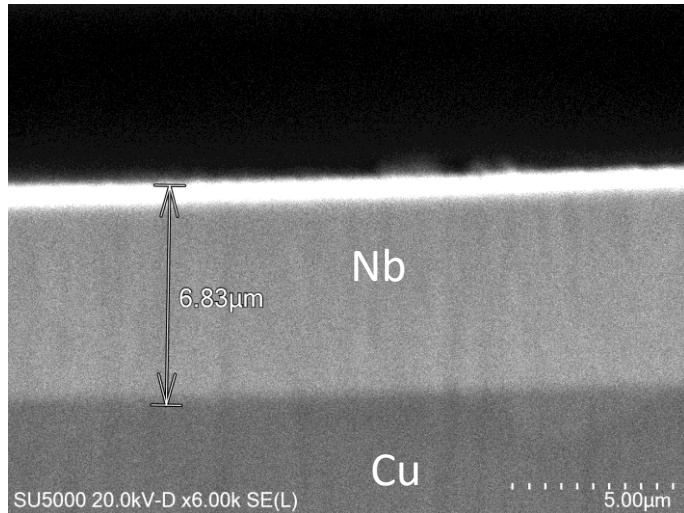
11/02/2025

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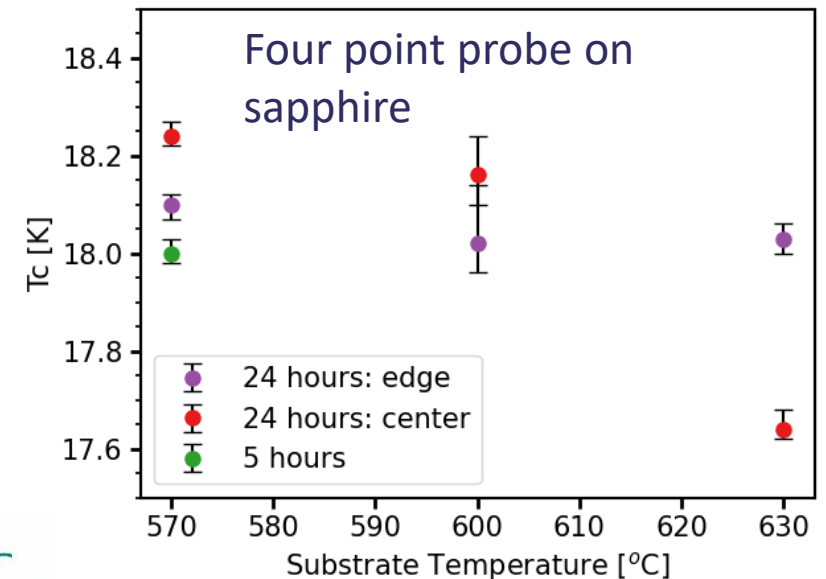
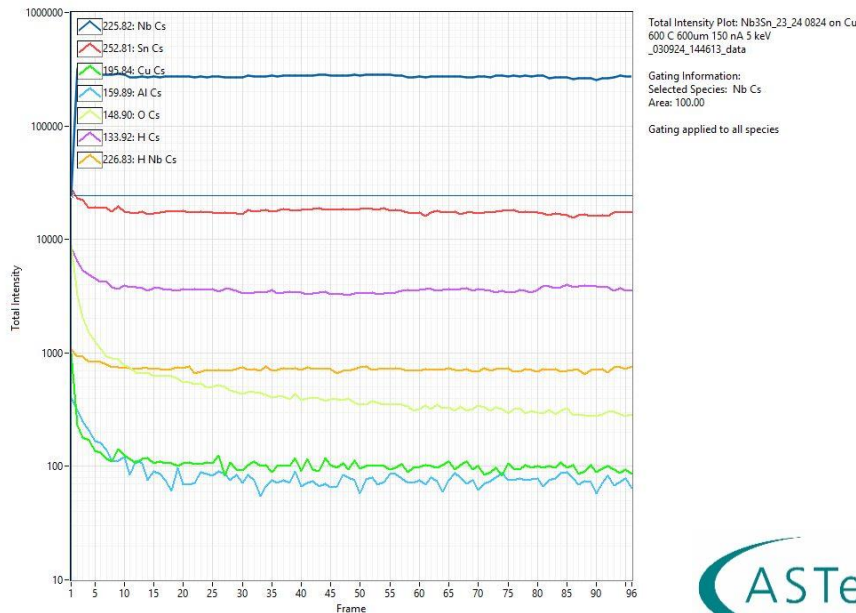


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Nb3Sn Deposition Temperature Optimisation

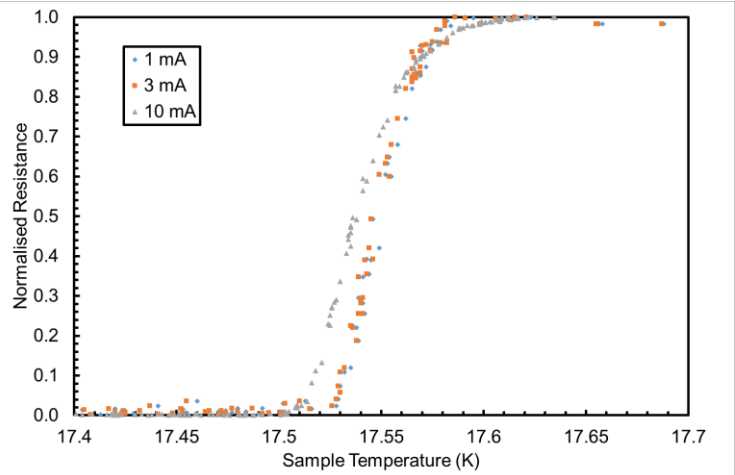
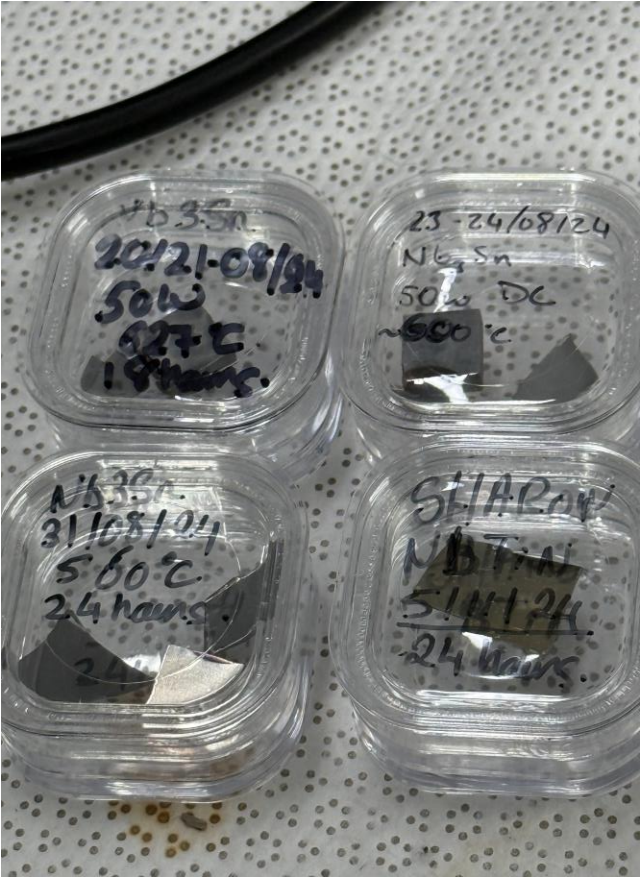


- Nb3Sn with bulk like properties is synthesised at 570 C and 50 W
- The film is very uniform in stoichiometry through out the depth with the lowest level of oxygen and Cu
- Very sharp interface and good adhesion

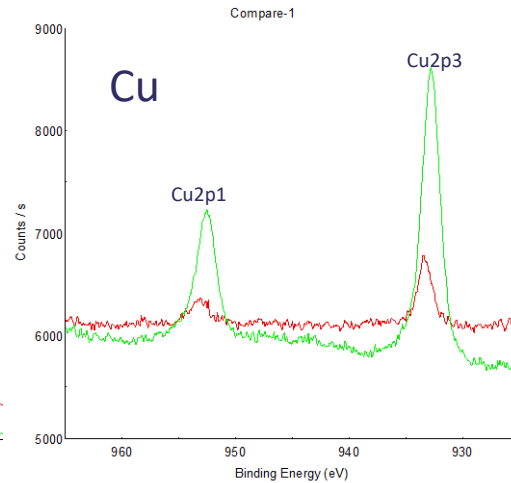
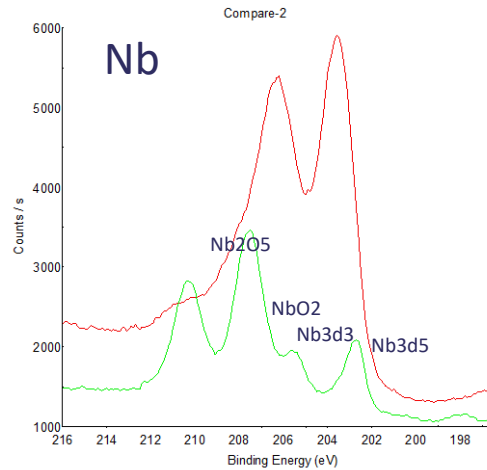
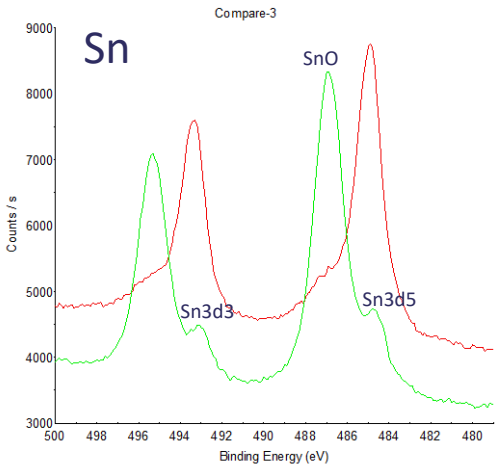
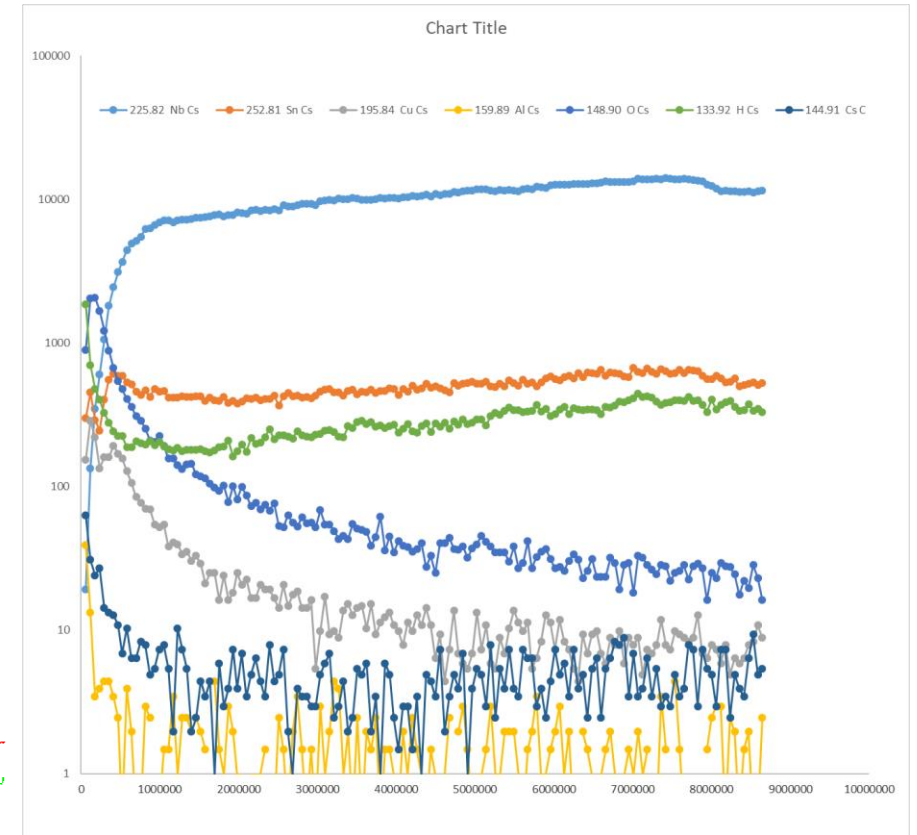
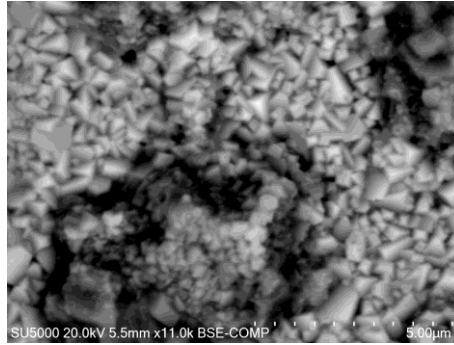
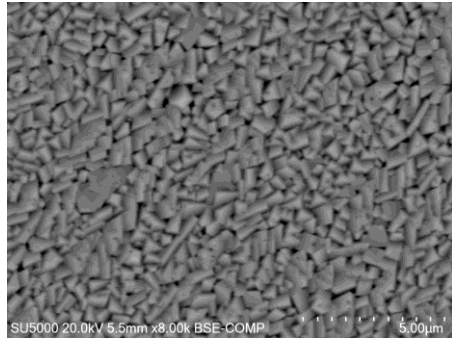
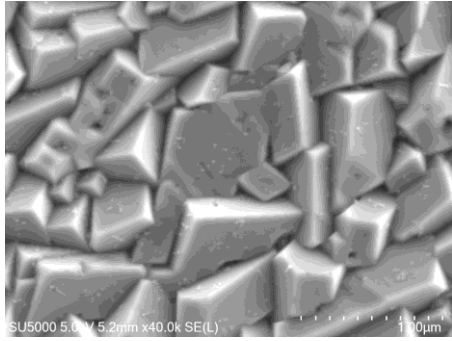


Follow up of the samples

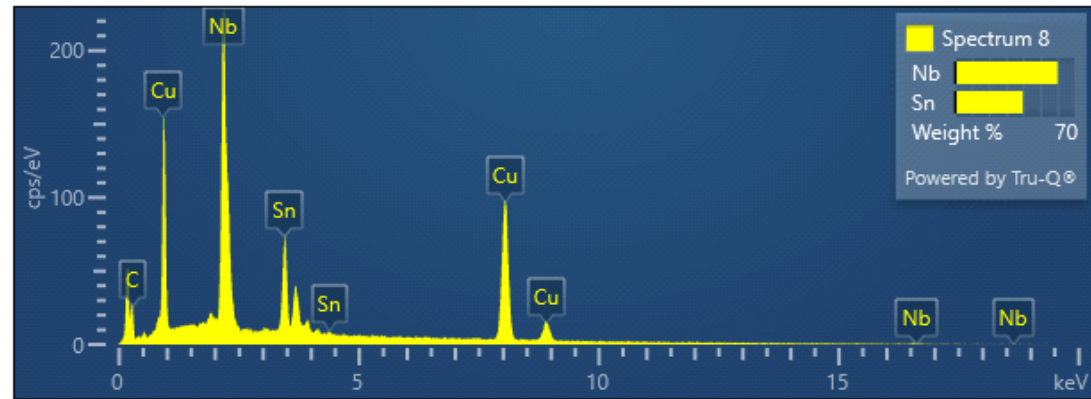
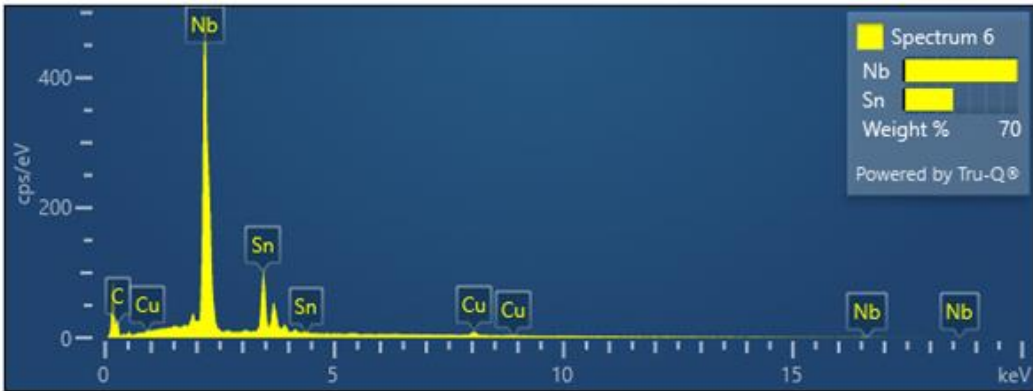
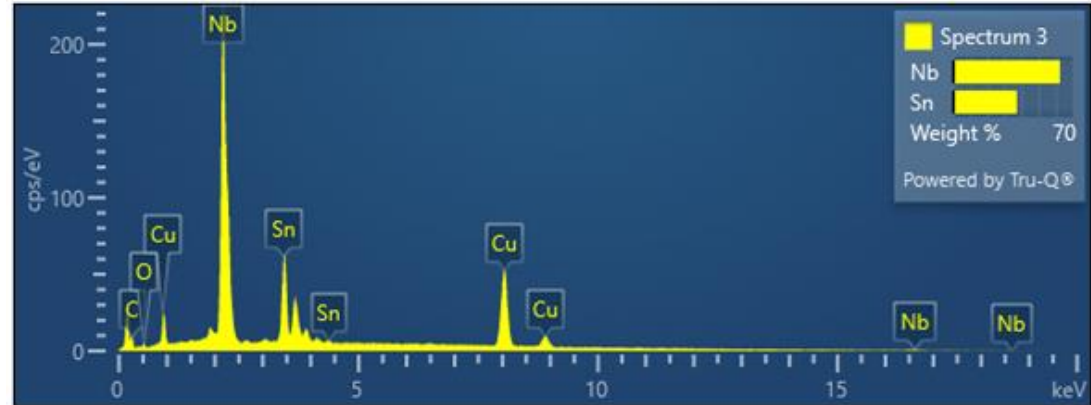
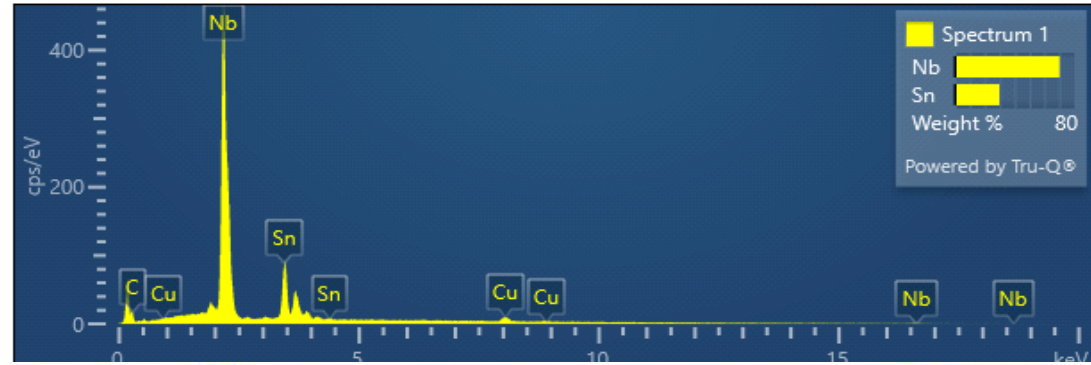
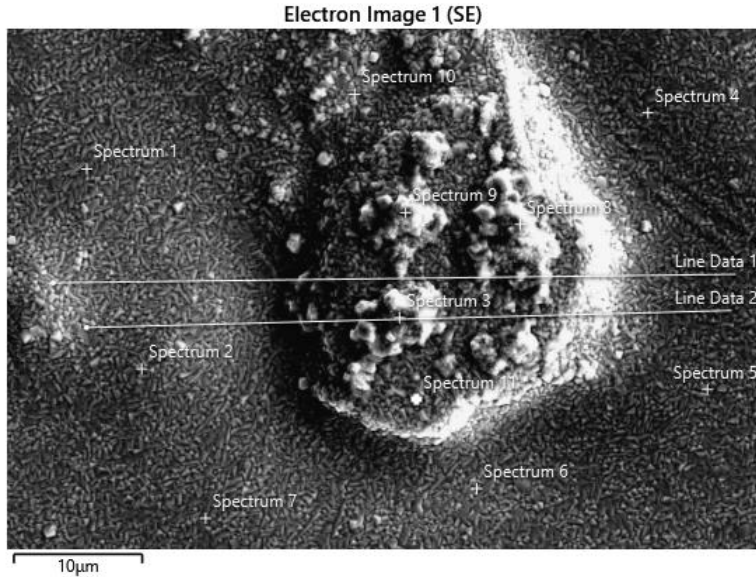
- Three of the samples with the highest T_c were sent for point contact tunnelling (PDC) for both TC, bandgap measurement and XRD.
- For each set both sapphire and copper witness sample was sent.
- Also a NbTiN deposited on sapphire in Sharon for 24 hours and RRR tested here which gave 17. was also sent.
- Nb₃Sn and NbTiN also sent to HZBDR for positron annihilation for point defect measurement.



Nb₃Sn dep on INFN Cu after NEG Cartridge



Nb3Sn dep on INFN Cu after NEG Cartridge



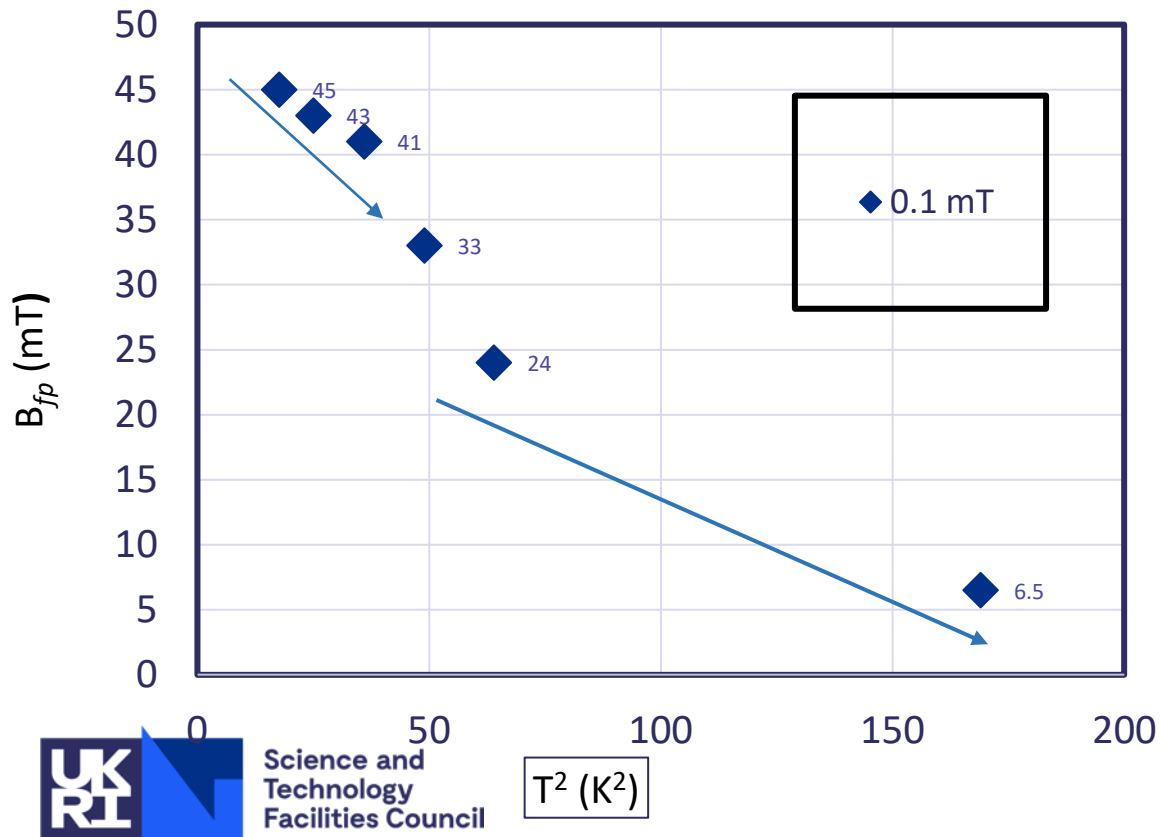
Nb3Sn

25/01/25

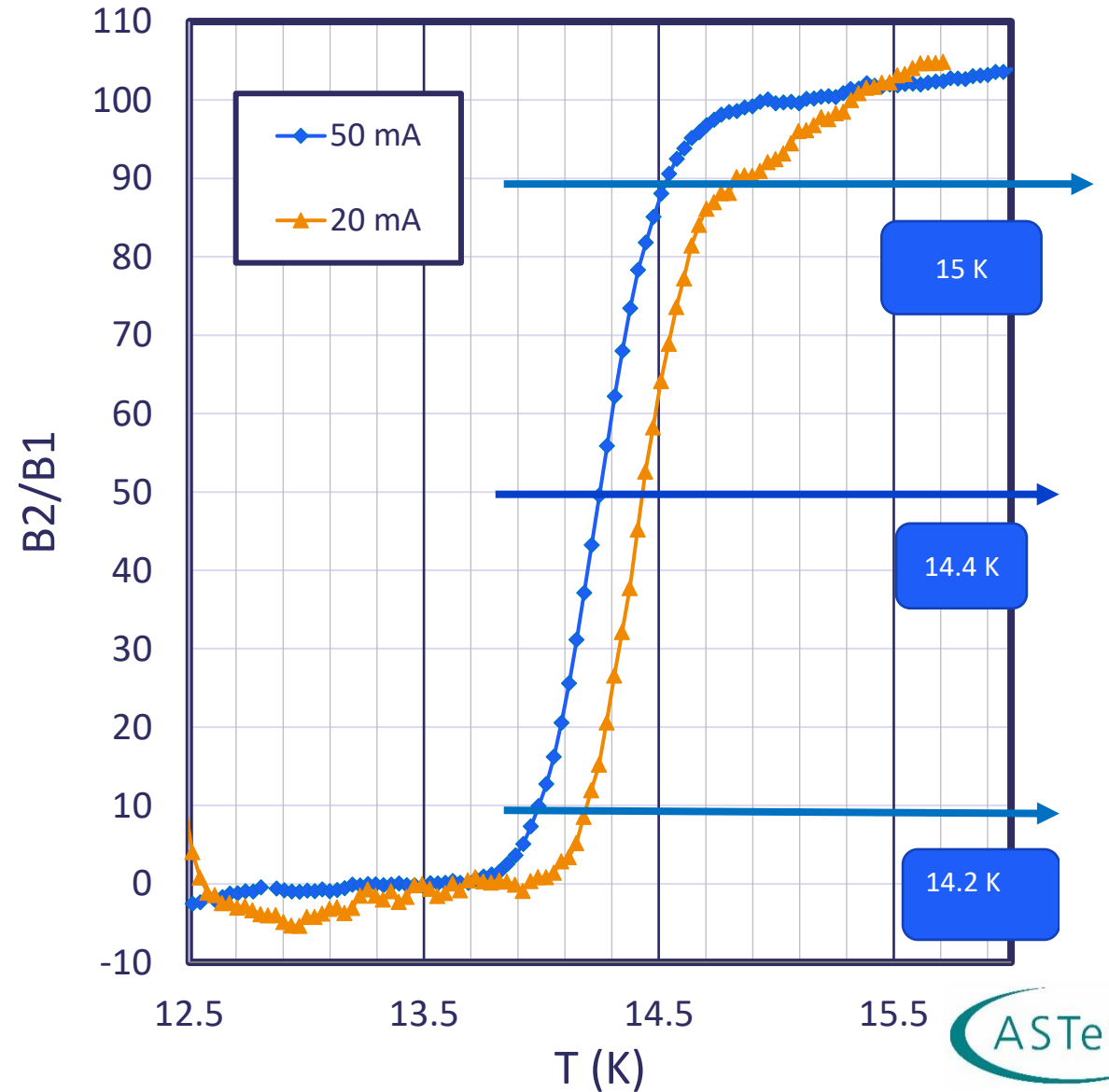
Sample deposited by INFN and tested at Daresbury Laboratory.



Point of full Flux Penetration [B_{fp}] measured by the Magnetic Field Penetration Facility [MFPF].



Critical Temperature [T_c] measured by the Magnetic Field Penetration Facility [MFPF].



6 GHz cavity

6 GHz cavity deposited NbTiN



- Cavity to be shipped to INFN
- Ideally tested at low power at Daresbury and then sent to INFN.
- Waiting for new cavity to be shipped from INFN

NbTiN (Twisted)(Rod)

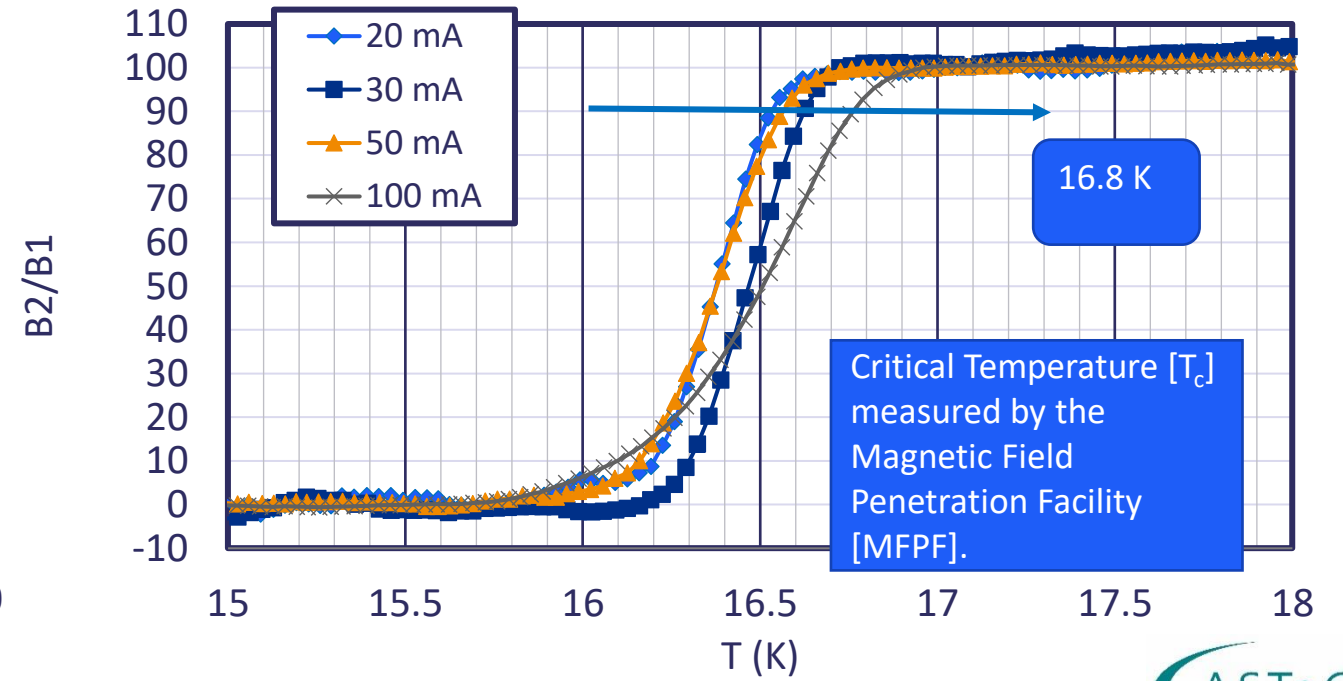
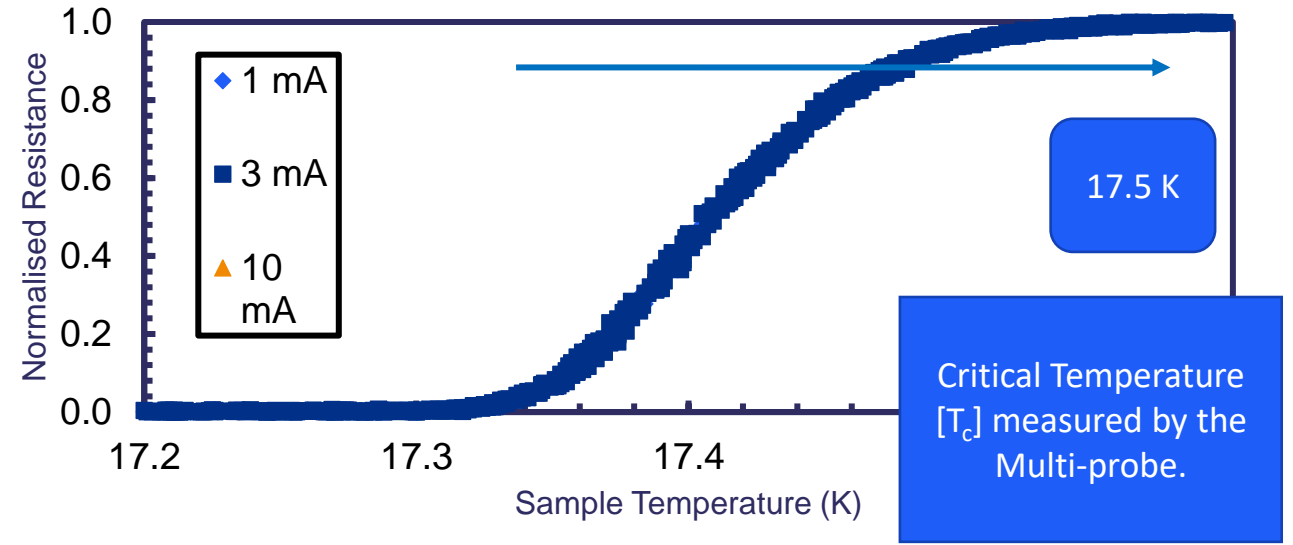
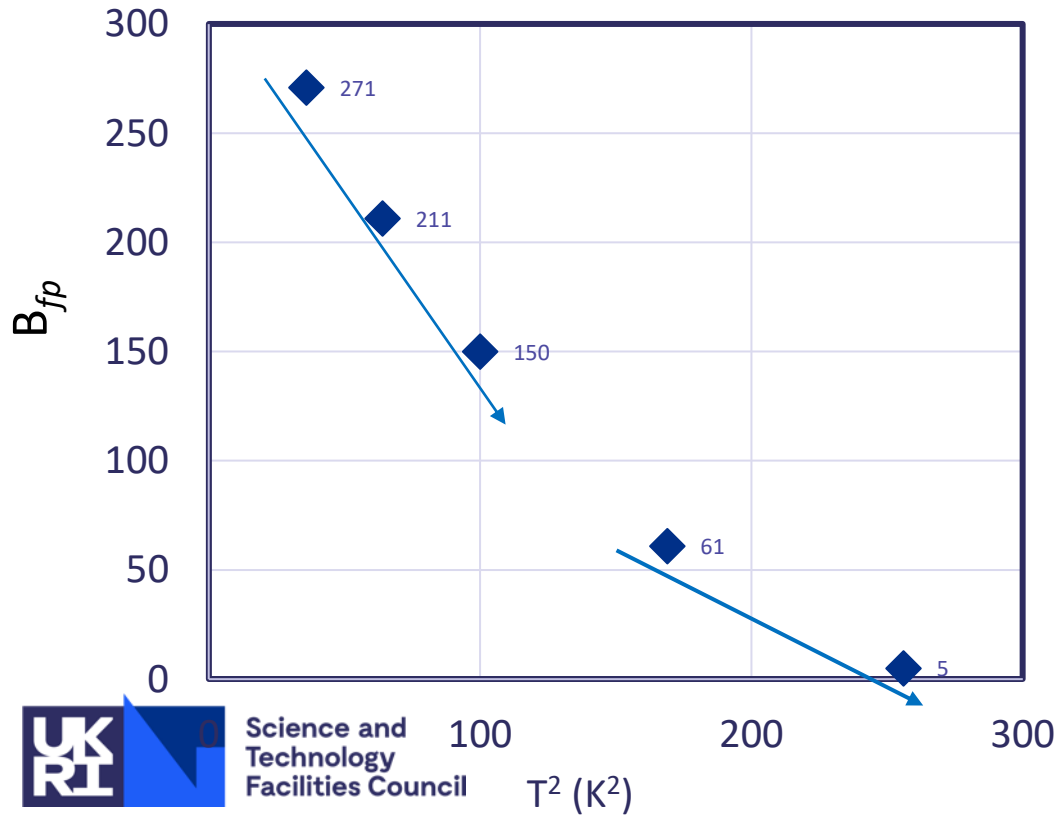
17/01/25. Darcy.



Two samples tested:

- Multi-probe: T_c measured on Sapphire [$\phi = < 10\text{mm}$].
- MFPF: B_{fp} & T_c measured on Cu [$\phi = 50\text{ mm}$].

Point of full Flux Penetration [B_{fp}] measured by the Magnetic Field Penetration Facility [MFPF].



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Future work

➤ Planar samples:

- ❖ Nb₃Sn on copper disk for RF surface resistance
 - Nb₃Sn on Thick Nb underlayer
 - Nb₃Sn with 3 different layer thickness 6h, 12h and 24 hours
 - V₃Si on copper(Lower Priority)
- ❖ Nb₃Sn on Sapphire disk
 - With copper under layer
 - With copper under layer and Nb

➤ QPR

- ❖ Waiting for the QPR to arrive from HZB

➤ 6 GHz Cavity

- ❖ Close cavity with NbTiN deposition in Darcy (to be measured at INFN)
- ❖ Open cavity with Nb₃Sn deposition in Sharon new chamber (to be measured at Surf lab)

➤ 1.3 GHz cavity for Nb₃Sn deposition

- ❖ Open cavity
- ❖ Close Nb cavity (3 cavities)
- ❖ Close diamond turned Cu cavity from CERN
- ❖ Close hydroformed Cu cavity coated with Nb at CERN ready for deposition of Nb₃Sn.