Coating the FCC beamscreen chamber with $REBa_2Cu_3O_{7-x}$ coated conductors

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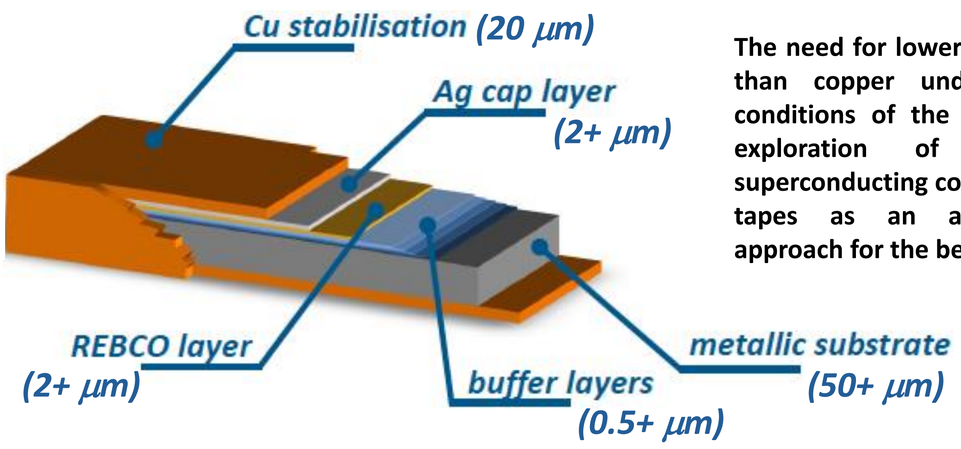
We demonstrate the feasibility of coating the FCC beamscreen chamber with coated conductors to achieve a surface resistance that significantly outperforms that of Cu under the FCC-hh working conditions.

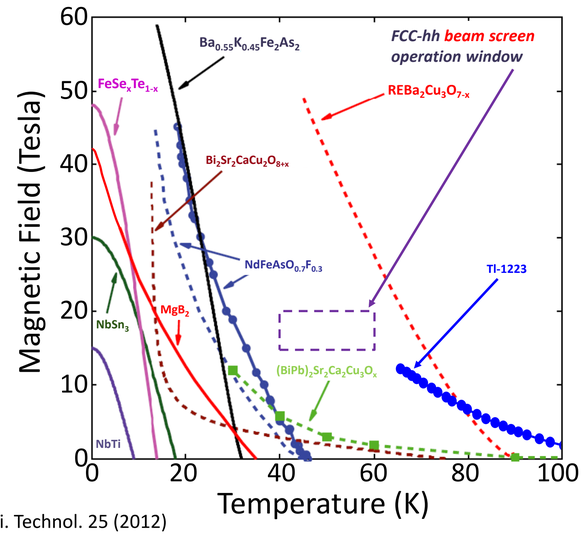
Background

Architecture of a Coated Conductor

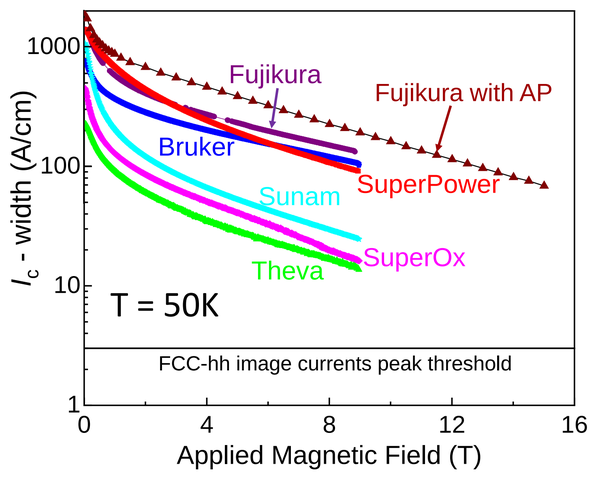


The need for lower surface impedance than copper under the operating conditions of the FCC motivates the exploration of high-temperature superconducting coated conductor (CC) tapes as an alternative coating approach for the beamscreen.

Superconducting phase diagram[1]



Coated conductor critical current

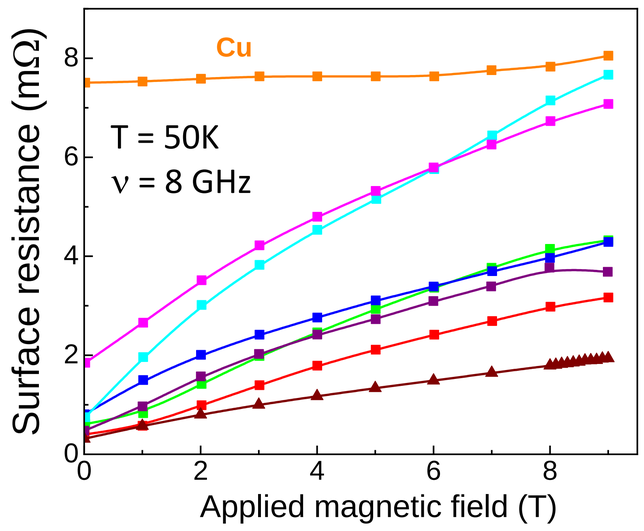


[1] Y. Ma. Supercond. Sci. Technol. 25 (2012)

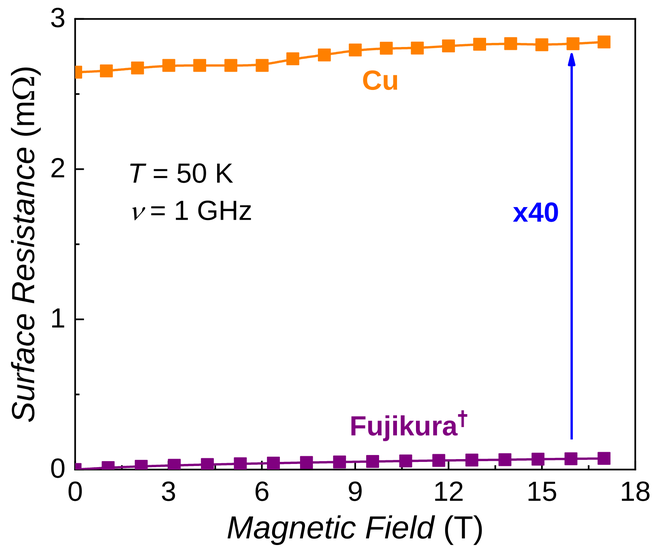
Surface Resistance of coated conductors*

**Attend to the Special Technologies sessions, abstracts #440 and #450, on 26/06/2019 @14:10 and @14:30 for more information.*

We have shown that the surface resistance of $REBa_2Cu_3O_{7-x}$ coated conductors out performs that of copper at 8 GHz, 50 K and up to 9 T.



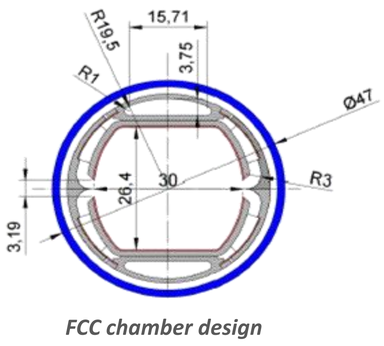
The rigid-fluxon model[2], predicts that this trend will be much more accentuated at the frequency spectrum of the FCC-hh image currents.



*†Prediction according to the **rigid-fluxon** model based on the experimental characterization of the J_c, B_{c2}, T_c and ρ of the coated conductor. Abstract #440 on 26/06/2019 @14:30 for more information.*

[2] Calatroni, Sergio, and Ruggero Vaglio;*IEEE Transactions on Applied Superconductivity* 27 (2017)

Coating the FCC-hh beamscreen chamber



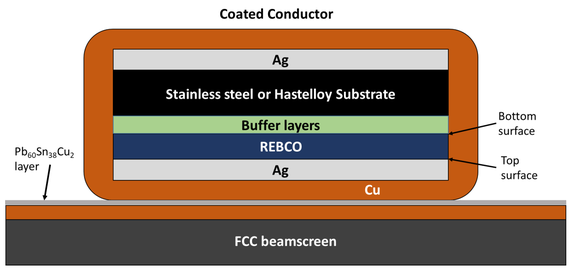
FCC chamber design

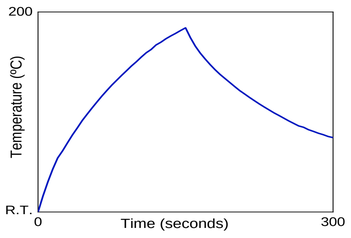
The challenge now remains on how to attach a coated conductor on the FCC beamscreen chamber steel. We use a scalable technology to form coated conductor / stainless steel stacks consisting of two steps:

1.- Low temperature welding

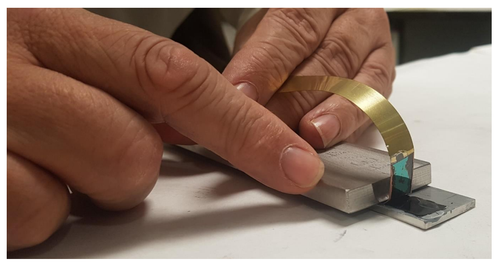
2.- Mechanical delamination

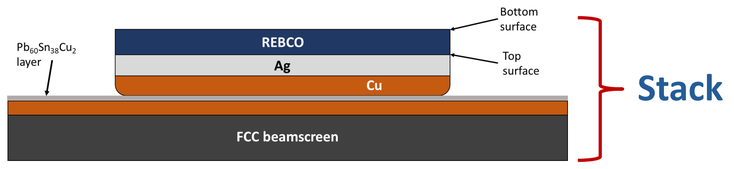
1.- Welding under a pressure load of 1Kg/cm²





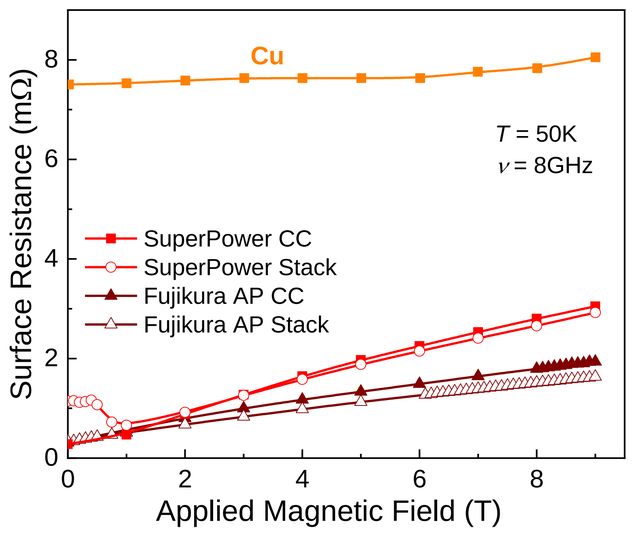
2.- Mechanical delamination



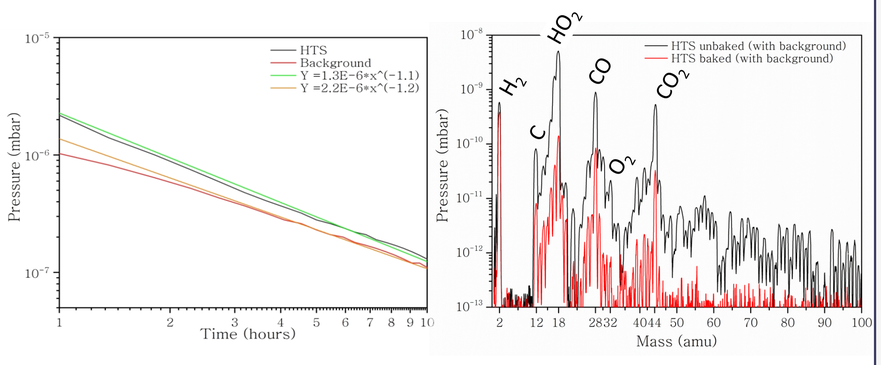


It is very important to study the mechanical properties of the stacks (bending radius, fatigue, strains under thermal cycling, magnetic quench…)

The surface resistance of the welded stack keeps the outstanding performance of the coated conductor.



The tendency shown by the stack agrees well with the tendency expected from a metallic system. The RGAs analysis did not show any high level contamination on the sample, demonstrating an excellent high-vacuum compatibility.



The fact that the sample is a small percentage of the surface under evaluation makes us cautious to extrapolate these observations and additional measurements with larger test samples are required to test the ultra-high vacuum compatibilities.

ACKNOWLEDGEMENTS

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