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Synthesis and study of Tl-1223 Superconducting Thin Films for the CERN Future Circular Collider (FCC-hh) Beam Screen

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The Future Circular Collider (FCC-hh) study is focused on achieving a 100TeV center-of-mass energy through the collision of proton beams steered by superconducting magnets cooled at 1.9 K in a 100 km circular collider. The circulating high-energy proton beams in the accelerator will emit 28W/m/beam of synchrotron radiation and to improve cryogenic efficiency, a beam screen, operating at 50 K is required to absorb the radiations and shield the magnets. At present, a copper coating is used to keep the beam coupling impedance low, but at 50K it might not be sufficient. High-temperature superconductors have a lower surface impedance than copper and a Tl-based superconducting thin film could be befitting this purpose among HTS-systems.

For this work, at CNR SPIN, several techniques are being employed that allow high-quality films to be grown on different substrates. We use electrodeposition, pulse laser deposition, and spin coating methods for the deposition of thin film precursors. Our recent work is directed at trying to improve the Tl-1223 phase in the thin films. For this purpose, various techniques, compositions, and substrates are under study and a variety of substrate have been investigated for the growth of Tl-1223 film, but the study of silver and SrTiO₃ is of major interest.

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