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Advanced Fabrication and Vacuum Compatibility of Tl-1223 Superconducting Thin Films for the Future Circular Collider (FCC-hh) Beam Screen

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The properties of high-temperature thallium-based superconductors are being studied in view of a possible coating for the beam shield of the future Circle Collider (FCC-hh). Research on the FCC-hh is focused on achieving a centre-of-mass energy of 100 TeV by colliding beams (guided by 16 T superconducting magnets). The beam stability and the safety of the cryogenic systems are two of the most critical aspects in such accelerators. According to theoretical estimations, the surface resistance of copper as currently used in the LHC at CERN may not be low enough to cope with the instabilities in the envisaged temperature range (40-60 K) of the FCC-hh. Therefore, high-temperature superconducting coatings have been proposed as alternative low-resistance materials.

We have been fabricating and analysing thallium-based superconducting samples to contribute to this research. The different techniques used to synthesise Tl-1223 superconducting samples, their characterisation, vacuum compatibility and recent improvements will be introduced. Furthermore, the current and future agenda in light of the new project aiming at understanding the actual feasibility of the coating for this application in an extreme environment will be discussed.

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