1. Record Nr. UNINA9911034864703321

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Titolo	Applicability of No-insulation High-Temperature Superconductor Saddle-Shaped Dipole Magnet to Particle Accelerator / / by Geonyoung Kim
Pubbl/distr/stampa	Singapore : , : Springer Nature Singapore : , : Imprint : Springer, , 2025
ISBN	981-9511-31-3
Edizione	[1st ed. 2025.]
Descrizione fisica	1 online resource (174 pages)
Collana	Springer Theses, Recognizing Outstanding Ph.D. Research, , 2190-5061
Disciplina	541.0421 620.112973
Soggetti	Superconductors - Chemistry Materials Chemistry Superconductivity Superconductors Magnetic materials Particle accelerators Materials Chemistry Magnetic Materials Accelerator Physics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Abstract -- 1 INTRODUCTION -- 2 ANALYSIS METHODS FOR SADDLE-SHAPED DIPOLE MAGNET ADOPTING NO-INSULATION TECHNIQUE -- 3 DESIGN, CONSTRUCTION, AND OPERATION OF SADDLE-SHAPED DIPOLE MAGNET -- 4 EXPERIMENTAL RESULTS AND ANALYSIS OF HTS SADDLE-SHAPED DIPOLE MAGNET -- 5 CONCLUSION -- Appendix.
Sommario/riassunto	This thesis addresses research on the design, fabrication, and operation of the first saddle-shaped dipole magnet for particle accelerators using a no-insulation high-temperature superconducting (HTS) magnet technology. Unlike HTS magnets with various geometries used in other applications, saddle-shaped magnets posed unresolved

challenges in analysis and fabrication due to their complex shape. This thesis is the first study to systematically classify these issues and propose detailed solutions for each. Scaling up the techniques used in this research could enable the development of dipole magnets exceeding 20 T, significantly enhancing particle accelerator performance. Institutions such as CERN and INFN-LASA are pursuing high-field HTS magnets, and this study has led to international collaborations, including Horizon Europe and the International Muon Collider Collaboration. This research has opened a new chapter in foundational technology for particle accelerators, which are widely adopted in particle physics, cancer treatment, chemistry, biotechnology, and materials science. Moreover, it addresses major challenges in HTS magnet technology, such as precise estimation of critical current, screening current analysis, and quench repetition experiments and analysis, by defining these problems and presenting viable solutions with experimental validations.