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Fri-Af-Po.06-08: Experimental Study on Innovative Methods to Improve Electromechanical Performance in Insert HTS Coil

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The central magnetic field of current all-superconducting hybrid magnets used in engineering applications is limited to below 40 T, primarily due to challenges such as screening-current-induced stress (SCIS)and high background magnetic field. SCIS significantly impacts the electromechanical performance of insert high-temperature superconducting (HTS) coils, particularly under high background fields. To address this limitation, effective mitigation strategies are critical for designing HTS coils capable of operating above 40 T.In this study, we conducted a comprehensive experimental investigation into innovative methods for enhancing the electromechanical performance of insert HTS coils. The research began with a theoretical analysis to elucidate the mechanisms underlying SCIS generation. Building on this foundation, two novel approaches were proposed to mitigate SCIS. These methods were subjected to experimental validation under high-field conditions. The results demonstrated substantial improvements in the mechanical robustness of the coils and confirmed the feasibility of the proposed strategies. Furthermore, the advantages and limitations of each method were systematically analyzed in the context of engineering applications. This work presents a significant step toward optimizing the electromagnetic and mechanical design of HTS coils for high-field applications exceeding 40 T, providing valuable insights for the development of next-generation superconducting magnet systems.

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