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Wed-Mo-Po3.13-09 [117]: Design Optimization of 2G High-Tc Superconducting Magnet for High Speed Transportation

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Motivated by growing needs for high speed transportation system, Korea Railroad Research Institute (KRRI) has developed the core technology of HTX (HyperTube eXpress) that operates vacuum tube above 1000 km/h. In order to achieve subsonic speed and dynamic stability, efficient propulsion and levitation systems are required, and consequently the subsonic capsule train has been developed by the linear synchronous motor and electrodynamic suspension based on superconducting magnet (SCM). Furthermore, detachable cryocooler system for the 2G high-Tc superconducting magnet (HTSM) enables to reduce the weight of the capsule train. However, the advantage of the 2G HTSM is accompanied by several problems including performance loss caused by increased operating temperature and relatively high wire price.

The purpose of this paper is to find effective 2G HTSM design for the subsonic capsule train. In the view of the cost and performance respectively, the wire volume and critical current can be improved by optimizing the coil shape of the 2G HTSM. While the 2G HTSM design is belong to non-linear optimization problem, non-linear critical current conditions which varies with the self-field direction are efficiently converted to simple linear constraint, and then the design problem is converted to a number of linear topology optimization problems. With many solutions for various constrains, most preferred SCM design is determined by considering its shape, cost, and performance. Also, one of the SCM design is fabricated to illustrate and evaluate the optimization result.

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