27th International Conference on Magnet Technology (MT27)
Fukuoka, Japan / 2021

Contribution ID: **1022** Contribution code: **WED-PO2-510-02** Type: **Poster**

Design, fabrication and testing of a coated superconductor magnet for electrodynamic suspension

Wednesday 17 November 2021 10:30 (20 minutes)

Coated superconductor magnets have already proved their feasibility in electrodynamic suspension (EDS) application as the on-board magnet, making the liquid-helium-free EDS train become possible. This paper designs a racetrack REBCO magnet served as the on-board magnet of EDS train, including the designs of both the REBCO coil composed of eight double pancake (DP) coils and the tailored cryogenic vessel us-ing conduction cooling. The REBCO magnet is designed to be detachable such that the REBCO coil can be taken out and put in the cryogenic vessel without breaking the REBCO magnet. Then, eight DP coils are wound and their critical currents are measured at liquid nitrogen temperature to assess their perfor-mances and accordingly determine their locations in the REBCO coil with the magnetic field distribution considered. Lastly, the key parameters of the REBCO magnet, such as the coil voltages, power losses, magnetic field distribution, and temperature distribution, are measured under the conduction-cooled con-dition. The safety margin of REBCO magnet operated at the designed current is predicted according to the measured voltage-current curve of the most dangerous DP coil as well as the critical current of the super-conducting current lead.

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Session Classification: WED-PO2-510 Maglev and Levitation II