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C2Po1B-09: Investigation of Levitation Force for Attractive Magnetic Levitation Train using HTS Bulk

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We have been studied a magnetic levitation system which is constructed of a high temperature superconducting (HTS) coil, a HTS bulk, and an iron rail. The levitation force is generated by using bending of magnetic flux lines due to a magnetic shielding effect of the HTS bulk. In our former works, we constructed desktop-size experimental arrangement, demonstrated the levitation properties, and analyzed numerically some variations of the HTS coils such as a racetrack coil.
Our next step is scale-up of the levitation system for supposing a real-size vehicle. To support about 30 tons of the vehicle weight with the 4 levitation systems mounted at the 4 corners of the body, it is necessary to generate 7.5 tons of the levitation force by each levitation system. We designed a large-scale system that scaled up the size of the HTS racetrack coil, the HTS bulk, and the iron rail in the desk-top size system by a factor of 10, and numerically estimated the levitation properties. The typical size of the racetrack coil is that the inner and outer diameters are 60 and 100 cm respectively, the height is 10 cm, and the straight section is 200 to 300 cm. According to the simulation results, the large-scale system generated approximately 5 to 10 cm of a levitation gap between the body and the rail, and over 10 tons of the levitation force in each system.
In conclusion, sum of levitation forces generated by the 4 systems mounted at the corners of the body becomes over 40 tons; hence we think the large-scale system have enough force to levitate the real-size vehicle.

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