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Improvement of the propulsion force by the excitation principle of the propulsion coil in the permanent magnet-HTS hybrid Magnetically levitated transport system

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In conventional transport systems using wheels and belts, there are friction that generates wear of mechanical parts and consequently reduces the whole system efficiency and this a problem, especially when using it in special environments such as clean room. As a way to solve this problem, a magnetic levitation system was developed using magnetic levitation as main technology. Called Hybrid Magnetic Levitation System, this system combines the superconducting levitation, which has high stability but low levitation force, and levitation between permanent magnets, which has low stability but high repulse force. Moreover, the rails of this system are made of permanent magnets in Halbach Array to enhance the magnetic field on the upper side of the rail.

Because of superconducting levitation stability, stable levitation and guidance is given without control. For propulsion system, air core coils have been assembled on the rail along its length so that when it is excited by a current, the generated magnetic field drives the system efficiently. Interaction between the propulsion coils and the HTS that pins flux from the magnetic rail generates propulsion force.

The principle of propulsion method consists of magnetizing the back region of the superconductor and demagnetizing the front region of the superconductor.

In this paper, propulsion method is studied. The experimental device is developed. The propulsion coil installed on the magnetic rail acts the permanent magnet and HTS on the carrier. The effective excitation method of the propulsion coil is shown, and propulsion force increases. As the flux of the propulsion coil acts on the HTS on the carrier, influence on the HTS is investigated. From the results, there is little influence on the HTS, and stability of the levitation and guidance is confirmed.

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