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Design Considerations and Characteristics of Antenna Arrays for Wireless Power Charging System in Superconducting MAGLEV

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Recently super high speed magnetic levitation MAGLEV using high temperature superconducting (HTS) magnet has been expected as next generation transportation since superconducting magnet can keep mighty levitation force. The superconducting magnet at MAGLEV train should be continually charged with high power in order to keep stronger and stable levitation force. Practically, since conventional power supply unit should be attached to HTS magnet in the MAGLEV, a large thermal loss is indispensably caused by power transfer wires and joints, those have been one of essential obstacles in the superconducting MAGLEV train. As the wireless power transfer (WPT) technology based on strongly resonance coupled method realizes large power charging without any wires through the air, there are advantages compared with the wired counterparts, such as convenient, safety and fearless transmission of power during movement. From this reason, the WPT systems have started to be applied to the wireless charging for various power applications such as transportations (train, underwater ship, electric vehicle). However, it has obstacles to commercialize such as delivery distance and efficiency. To solve the problems, authors proposed the technical fusion using HTS resonance coil in the WPT system since the superconducting wire has merits a larger current density and higher Q value than normal conducting wire. In this study, authors described the design consideration of multi copper antenna (Tx) coils for different sizes corresponding to HTS receiver (Rx) coil. In this paper, the priority characteristics and thermal distributions of multi copper antenna arrays with moving HTS receivers are experimentally compared under radio frequency (RF) power of 370 and 100 kHz below 500 W.

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