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Design and Performance for Wireless Power Charging Module combined with HTS Resonance Coils under Different Frequency Ranges in Superconducting MAGLEV Trainv

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The wireless power transfer (WPT) using magnetic resonance coupling method has been known to have the advantage of being able to transfer power across large air gap with considerably high efficiency. As well as, as such a method can eliminate the physical contact loss in the system, it provides an ideal solution for the problem of contact losses in the power applications. From these reasons, WPT technology has started to be applied to the wireless charging for various power applications such as transportations (electric vehicle, high speed MAGLEV train, capsule train with subsonic speed etc.). In the high speed superconducting magnetic levitation (MAGLEV) train, the antenna (Tx) coils, which are installed both sides of train, are placed on the guidance rail, as well as, superconducting receiver (Rx) coils can be installed in traveling train. In the superconducting system, a cooling vessel, which is made by steel materials, is a requisite subsystem. However, since the steel materials can shield electromagnetic field, the structure design of cooling vessel can affect the transfer efficiency. The inserted resonance coupling coils in wireless power charging system of MAGLEV magnet can be one of resonable options for the shielding of electromagnetic field since the inserted coupling coils can accomplish strong resonance coupling between Tx and Rx, which derives improved transfer power, compared with the surroundings of non-inserted resonance coils. In this study, authors present the design and performance of multi copper Tx coils for superconducting Rx coils under different inserted HTS resonance coils at 150, 370 and 750 kHz . Addtionally, authors evaluate operating characteristics for inserted resonators under the shielding surroundings of cooling vessel structure.

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