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High Temperature Superconducting Non-insulation Closed-loop Coils for Electro-dynamic Suspension System

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Null-flux Electro-dynamic suspension (EDS) system promises to be one of the feasible high-speed maglev systems above 600 km/h. Due to its greater current-carrying capacity, superconducting magnet can provide super-magnetomotive force that is required for null-flux EDS system and cannot be provided by electromagnets and permanent magnets. There is already a relatively mature high-speed maglev technology with low temperature superconducting (LTS) magnets as the core, which work in the liquid helium temperature region ($T \leq 4.2$ K). 2-Generation high temperature superconducting (HTS) magnet wound by REBa₂Cu₃O_{7- δ} (REBCO, RE=rare earth) tapes works above 20 K region, and can get rid of the dependence on liquid helium which is rare on earth. This paper designed HTS no-insulation closed-loop coils applied for EDS system and energized with persistent current switch. The coils can work at persistent current model and has premier thermal quench self-protection. Besides, a full size double-pancake module was designed and manufactured in this paper, and it was tested in liquid nitrogen. The double-pancake module's critical current is about 54 A and it is capable of working at persistent current model, whose average decay rate measured in 12 hours is 0.58%/day.

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