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Methods to Increase the Pumping Rate of Rotary HTS Flux-pump with Rotating HTS Tape to Charge the Field Coil of the Synchronous Motor.

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Recently, the Rotary flux-pump using HTS tape has been researched to apply for superconducting applications. In this paper, we studied the charging characteristics of the field coil of the HTS synchronous motor that field coil is charged by Rotary HTS flux-pump. The two advantages can be obtained by using Rotary HTS flux-pump to the synchronous motor. 1) The high thermal efficiency 2) simple cryogenic design because the direct physical connection is not necessary. The prototype of the rotary HTS flux-pump with rotating HTS tape is fabricated to investigate the basic charging characteristics. In the test model, the HTS tapes and the coil are rotated together and the permanent magnet is fixed outside of the rotor because it is similar to the actual model of the synchronous motor. The N50 permanent magnet is used to apply the magnetic flux into the HTS tape. The charging speed of the rotary HTS flux-pump is closely related to magnetic flux linkage on the HTS tape. To increase the pumping rate of the flux-pump, the test of case 1 was conducted with respect to the different background material like iron or Permalloy of the HTS tape. In the test of case 2, the two HTS tape was overlapped to extend the flux linkage area on the HTS tape and each HTS tape was connected to HTS coil together. In order to measure the charging speed and pumping rate with respect to the magnetic flux changes, a hall sensor was installed at the center of the HTS coil.

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