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Tue-Mo-Po2.12-06 [104]: Conceptual design and electromagnetic analysis of superconducting induction motors using REBa2Cu3Oy tapes

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High power density motors are required for electric propulsion systems of future electric aircrafts, flying cars and electric vehicles. The highest power density of the conventional motor for aircrafts is reported as 5.5 kW / kg. Superconducting rotating machines have a potential to realize higher power density due to its high current density and low loss property. In this study induction motors which has air-cored superconducting armature windings are developed. The first target in the power density of the superconducting motor is 20 kW / kg. The superconducting tapes for the armature windings were BaHfO3-doped EuBa2Cu3Oy ones fabricated by IBAD-PLD technique. The AC losses of the tapes were actually observed by a pickup-coil method and partially estimated by using theoretical expressions such as a temperature scaling law. For the reduction of the AC loss in armature windings, a laser-scribing technique and transposed parallel conductors which were developed in our previous studies were applied. The electromagnetic design and analysis were carried out by using JMAG Designer. The output power, number of magnetic pole and operating temperatures were set as 100 kW, four poles and liquid nitrogen temperature of 65-77 K, respectively. The dependences of the power density and efficiency on the size (diameter and effective length), frequency and number of turns of armature windings were investigated. The detailed analysis results will be reported in this conference.
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