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Study on the structure design for high performance non-contact rotating machine using HTS bulks

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There are already a wide variety of medical mixers used in the pharmaceutical manufacturing process, and they have contributed greatly to many people suffering from diseases. However, most of the rotating machine used in current medical mixers adopt the mechanical bearing system, and dust is generated by friction with the rotating shaft. In addition, the contact rotating system has disadvantages of low energy efficiency and maintenance of the connecting part is required. On the other hand, although the controlled magnetic bearing allowed non-contact rotation is applied in some cases, it cannot get high torque since its very small load capacity. Therefore, we have been investigating the development of non-contact rotating machine using high temperature superconducting (HTS) bulks to enable the agitation process in clean circumstances. The non-contact rotating machine combined with ring-shaped HTS bulks and permanent magnet was proposed and investigated experimentally. The permanent magnet was arranged between HTS bulks and it is integrated with the rotor shaft. The HTS bulks were magnetized by the permanent magnet with field cooling method by liquid nitrogen. Therefore, the permanent magnet played a role of magnetic source. Since our current research aims to develop a medical mixer with a capacity of 600L to 1,000L, the proposed medical mixer using the HTS bulks requires not only high-speed rotation but also high torque. Therefore, in this study, we investigated the structure of a non-contact rotating machine that can achieve both high-speed rotation and high torque. Until now, only HTS bulks have been used as magnetic bearings for levitation, but in this study, we propose a structure that combines a superconducting coil and HTS bulks. The trapped field properties in HTS bulks by superconducting coil are analytically investigated using based on FEM analysis and optimized structure of magnetic bearing part will be reported.

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