

Stable levitation of permanent magnet above cryocooler-cooled superconducting bulk magnet and non-contact stirrer

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In pharmaceutical manufacturing, single-use manufacturing, which eliminates external contamination, is gaining attention. Stirring wings placed inside pharmaceutical tanks need to be held and moved without touching the walls. Non-contact magnetic levitation, one of the unique properties of high-temperature superconductivity, has already been utilized for non-contact mixing. By cooling a high-temperature superconducting sintered pellet (referred to as bulk) to temperatures lower than liquid nitrogen using a refrigerator and capturing the magnetic flux distribution from an external magnet, we achieved levitation of up to 30 mm above the magnetic pole. We evaluated the horizontal drag of the magnet at a levitation distance of 10 mm from the bulk, and achieved levitation stability of 10 N. We rotated the HTS bulk magnet along the central axis of the refrigerator to evaluate its magnetic field capture performance. Utilizing this performance, we successfully created a non-contact stirrer.