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Levitation Performance of Bulk YBCO and GdBCO Under a Low-Pressure Condition

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The high temperature superconducting (HTS) bulk in cryostats is an important part of HTS maglev systems. For the potential application to evacuated tube transportation, it is necessary to recognize the levitation and guidance performance of the bulk under a low-pressure condition. Based on a home-made pressure-reducing platform, we have studied the levitation performance of two kinds of bulks (YBCO and GdBCO) above a Halbach permanent magnet guideway (PMG) under different pressure conditions. Measurements of the levitation force versus vertical motion and the force relaxation were performed in the cases of field-cooling (FC) and zero-field-cooling (ZFC), and measurements of the guidance force versus horizontal motion at a levitation height of 12 mm were performed in the FC case. The experimental results show that the reduced air pressure can significantly improve the levitation force, the force relaxation and the guidance force due to the increasing critical current of HTS bulks in the low-pressure environment, and this phenomenon is universal in the two kinds of bulks. The levitation force of YBCO, GdBCO can increase up to 10.1% and 10.7% in FC, 20.9% and 19.1% in ZFC at 0.2 atm compared with the atmospheric pressure, respectively. The guidance force in FC can increase up to 13.8% and 9.7%, respectively. Moreover, we have found a phenomenon that the same sized YBCO can get the similar levitation performance as GdBCO at low pressure with the same applied guideway. The results further prove the superiority of our work with the combination of HTS Maglev and evacuated tube.

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