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Experimental Research on the Translational Characteristics of High Temperature Superconducting Translational System

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The ground semi-physical simulation experiment is essential for the reliability verification of micro satellites equipped with micro thrusters. The HTS translational system based on the complete diamagnetism of superconductors is a feasible scheme. In order to explore the levitation force, translational characteristics and the factors affecting the performance of superconducting translational system, this article designs an experimental system model composed of superconducting plane spliced by YBCO superconducting blocks and permanent magnet structure under zero-field cooling condition. The bearing capacity and effective working range of superconducting plane are explored by measuring the distribution of superconducting levitation force in the surface. Also, the damping characteristics of the superconducting translational system are analyzed by processing the motion trajectory. In addition, the effects of different superconducting plane areas and the number of permanent magnets in the permanent magnet structure on the translational performance are also studied. The results show that the bearing capacity of the superconducting plane in the experimental system is over 10kg. However, the superconducting plane has a large edge effect, that is, the permanent magnet structure tends to move out of the surface when it is close to the edge. This paper analyzes that this may be caused by the attenuation of the shielding magnetic field at the edge of the superconducting plane. Meanwhile, the damping of the permanent magnet structure will increase when it moves above the splicing gap of the superconducting block. In addition, it is also found that the permanent magnet structure with a single permanent magnet is in an unstable equilibrium state above the plane, and rollover occurs when it is slightly disturbed.
Keywords: translational characteristics, HTS translational system, semi-physical simulation, zero-field cooling

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