

A Study on the Energy Storage Efficiency Improvement for the Superconductor Flywheel Energy Storage System

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The superconductor flywheel energy storage system (SFES) using superconductor bearing is very favorable for long lasting energy storage because the energy storage efficiency of SFES is higher than that of conventional flywheel energy storage system using mechanical bearing and magnetic bearing. The rotational losses in SFES are generated by superconductor bearing, the degree of a vacuum, and permanent magnet type motor/generator. These rotational losses decrease energy storage efficiency. In this paper, the method for improvement of energy storage efficiency was proposed by means of minimization of the rotational loss generated in case of using permanent magnet type motor/generator. To do this, vertical axis type SFES with strong levitation force was manufactured using journal type bearing which encircle flywheel axis with YBCO superconductor.

The rotational losses by superconductor bearing, the degree of a vacuum, and motor/generator were quantitatively assessed. To minimize the rotational loss by motor/generator among the various causes, by means of loss assessment generated by the core of motor/generator when inner radius and outer radius of the core was varied, the selection method of the core that rotational was minimized was proposed. From the test results, it was confirmed that energy storage efficient was improved through modification of inner radius and outer radius of the core.

Keyword: Superconductor flywheel energy storage system, rotational loss, permanent magnet