

Simulation and Experimental Validation of Inductive Excitation in HTS Flywheel Energy Storage System

The conventional flywheel energy storage technology is constrained by the mechanical strength of the material, which imposes an upper limit on the speed of the flywheel. In response to this limitation, at IHEP we have introduced a novel approach in the form of a superconducting flywheel energy storage system. This innovative system leverages radial electromagnetic forces to supply the necessary centripetal force, thus overcoming the speed limitations associated with traditional flywheel designs. We utilize outer background solenoid coils to provide magnetic field for the inner flywheel coils. The power delivery to the flywheel coil is facilitated via inductive excitation, effectively mitigating the impedance caused by current leads during the rotational operation. The flywheel coil, comprised of no-insulation (NI) coils impregnated with thin layer of solder, is intricately wound in a closed-loop double pancake configuration, thereby possessing a stable mechanical structure and mitigating the decay of current post-excitation effectively. Through a combination of electromagnetic simulation and experimental validation, this research validates the feasibility of inductive excitation and the sustained current retention capacity of the solder-impregnated closed-loop double pancake coil, laying essential groundwork for the innovative flywheel energy storage system.

Primary authors: 马, 瑞 (中国科学院高能物理研究所); 康, 芮 (高能所); 王娟 1, 娟 (中国科学院高能物理研究所); XU, Hang (IHEP); XU, Qingjin (高能所)

Presenter: 马, 瑞 (中国科学院高能物理研究所)

Session Classification: Poster