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Thu-Mo-Po4.02-06 [11]: Upgrade of sub-systems and performance improvement for a versatile multi-field test facility of superconducting wires and tapes

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A versatile facility capable of providing cryogenic-electro-magnetic multifields had been successfully constructed for investigating the field-dependent and mechanical properties of superconducting wires and tapes at Lanzhou University, China. It can generate a 3.5T transverse background field, and continuous variations of temperature (4 to 77K, ˜5K/min) and transport current (0 to 700 A, 3A/min) for versatile mechanical test of superconductors. With enormous efforts and R&D work, promising results have been achieved with the versatile facility. Aiming at the improvements of superconductors'property, the versatile multi-field test facility needs to be more upgraded on operating range and sub-system structures for background superconducting magnet and variable-temperature cryogenic system. This paper presents the latest results with upgrade of the versatile multi-field test facility. In the upgraded facility, the split superconducting solenoid magnets with the helium re-condensation system to circulate the evaporated helium gas were manufactured to generate a transverse background field up to 5.5 T in a relatively larger room space of ⊠100 mm ⊠ H1400 mm. For the purpose of experimental efficiency, an improved cryogenic system consisting of a vacuum Dewar vessel with a visible window cooled by a Gifford–McMahon (GM) cryocoolers for providing refrigeration was built independently to accommodate the room space of the background split magnet. Based on this new design, the rapid continuous variations of temperature (4 to 293 K, ˜15K/min) and transport current (0 to 1000 A, 3A/min) in the superconducting wires and tapes tests can be improved well. And the advanced instrumentation and the multi-field data acquisition system allow accurate measurements of dynamic strain and current distribution, transient stability, DC behavior, and AC losses. Upgrade of operating range and sub-systems for the versatile multi-field test facility will contribute to the progress in understanding design issues for superconducting wires, taps and cables under intense field, cryogenic temperature, transport current, and mechanical loading, also including quench propagation, material segregation, coupling loss, joint and cyclic load.

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