

New 30 m Flexible Hybrid Energy Transfer Line with Liquid Hydrogen and Superconducting MgB₂ Cable – Development and Test Results

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Abstract — R&D program for development of hybrid energy transfer lines the new 30 m MgB₂ superconducting cable with high voltage insulation has been developed and tested. The superconducting cable was inserted into newly developed flexible 30 m hydrogen cryogenic line that has three sections with different types of thermal insulation in each section. High voltage current leads were developed also. The superconducting cable, cryostat and current leads have been tested in October 2013. Cable critical current was ~ 3500 A at ~21 K. Cable and current leads passed high voltage test with 50 kV DC at liquid hydrogen temperature. The tests were performed at temperatures from 20 to 26 K, hydrogen flow from 70 to 450 g/s and pressure from 0.25 to 0.5 MPa. It was found that active evaporating cryostatting system as a thermal insulation practically eliminated heat transfer from room temperature to liquid hydrogen. The flexible 30 m hybrid energy transfer line developed is able to deliver ~ up to 60 MW of chemical power and ~ 75 MW of electrical power, i.e.~135 MW in total. MgB₂ cable design and test results of hybrid energy transfer lines are presented and discussed.

Keywords (Index Terms) — superconducting cables, MgB₂, liquid hydrogen, energy transmission