



**MT 26**  
**International Conference**  
**on Magnet Technology**  
Vancouver, Canada | 2019

Contribution ID: 1222

Type: **Poster Presentation**

## **Tue-Af-Po2.23-05 [92]: Development of a Prototype MgB<sub>2</sub> Superconducting Solenoid Magnet for High-Efficiency Klystron Applications**

*Tuesday, 24 September 2019 14:00 (2 hours)*

An MgB<sub>2</sub> superconducting magnet for X-band (12 GHz) Klystrons has been designed, manufactured and tested. According to a CLIC-380GeV staging scenario at CERN, about 5000 sets of klystrons will be used. The Klystrons need electron beam focusing solenoid magnets, and the power consumption of 5000 magnets using Cu conductor is estimated to be 100 MW in case. This MgB<sub>2</sub> superconducting solenoid magnet is planned to reduce the energy consumption to one tenth, 10 MW. And also the magnet is designed to absorb the stored energy by coils in case the quench occurs.

This paper describes the magnet design fulfilling above requirements, the test results of a preliminary experimental coil, and the test results of the prototype magnet. Two coils included in the magnet are conduction-cooled by using Sumitomo's cryocooler CH-204. This magnet is designed to produce 0.8 T at  $I = 57.1$  A, with a maximum field of 1.1 T in the coil winding. The coils were made by wind & react method and were resin-molded. In the performance test about 10 times quench tests including 10 % overcurrent one have been conducted and the coil temperature rise after quenches has been measured to be less than 200 K. The magnet has no deterioration. The field distribution has been measured and confirmed to agree with the simulated value.

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**Session Classification:** Tue-Af-Po2.23 - Novel and Other Applications I