Development of Prototype MgB₂ Superconducting Solenoid Magnet for High-efficiency Klystron Applications

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1. Introduction

1.1 Motivation

- Consumption energy
  - Refrigerator Power consumption
  - Low current design for power lead is effective!
- MgB₂ conductor parameters
  - O.D. = 0.67 mm
  - 10 filaments

1.2 Design and experimental approach

1.2.1 Energy-saving design concept and conductor parameters

- MgB₂ conductor parameters
  - O.D. = 0.67 mm
  - 10 filaments

1.2.2 Coil structure and magnet design

For passive quench protection

- Power supply
  - Turn off over 5 V

2. Results and discussion

2.1 Energy consumption

- Measured values
  - 1st stage: 13.2 W at 71.3 K
  - 2nd stage: 5.3 W at 14.7 K
  - Power consumption: 1.5 kW/magnet

2.2 Quench propagation velocity

- Forced quench test at 57 A
- Voltage taps on the coil surface

2.3 Temperature Rise

- Coil max. temperature
- Stored energy ratio: 1.5 times

3. Conclusion

- The performance test of the prototype MgB₂ magnet has been completed.
- Energy consumption per magnet is less than 3 kW.
- The coil has been passively protected through 13 times quench tests.

4. Future Plan

- Wind & react was adopted in this coil, but react & wind is supposed to be adopted in the future.
- MgB₂ superconducting magnets have huge potential for further development and in various areas including MRI applications.

Klystron system and the MgB₂ conductor are presented in Wed-Af-Po3.15-08 and Wed-Af-Po3.25-04.