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Status of RF power coupler for HWR In RISP

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A heavy-ion accelerator facility is under construction for Rare Isotope Science Project(RISP) in Korea. Four types of super conducting cavities, QWR, HWR, SSR1, and SSR2 are developed to accelerate the ion beams. The QWR cryomodule is already installed in the tunnel. The HWR cryomodule is transport to the tunnel. Here, the status of HWR RF power coupler is presented. After the fabrication, the coupler is test with high power RF. The some of the test results are described.

Requirements

Fabrication







Figure 2. Installation of HWR cryomodule in the tunnel



Figure 3. Simulation and Measurement of external Q

Figure 1. The incident RF power vs external Q

Figure 5. Drawing of HWR RF coupler

Figure 6. Fabricated HWR RF coupler cold section





Figure 7. Cleanroom assembly

Figure 8. DC bias tee and RF power coupler

Test Setup

Test Results







- As low power RF is applied to the coupler, the vacuum level and the temperature at the tube part is increased as shown in figure 12.
- After the RF conditioning, the RF is applied 3.0 kW in 1 hour. After 1 hour, 2.0 kW RF power is maintained in 1 hour. During the 3.0 kW and 2.0 kW RF power, the temperature at the ceramic window and the bellows part are monitored as shown in figure

6 kW SSPA unit

Figure 9. Block diagram of the test bench



Figure 11. Prepared test bench

Figure 10. Delivery package from the vendor



Figure 11. Temperature sensors

- The electromagnetic mode is standing wave mode.
- The node of the mode is located near the ceramic window.
- Three temperature sensors are attached to monitor the status of RF power coupler.(ceramic window, bellows, tube part)
- The cold cathode gauge is assembled at the lower port of the HWR cavity.

Summary

- Mass production of the HWR RF coupler is completed.
- **86** Solution 86 Coupler are test with high power RF (3.0 kW) before assembly with cryomodule.
- **1** coupler could not accepted for assembly with cryomodule due to the internal surface

Figure 12. Test results of HWR RF coupler



Figure 13. Visual inspection of non-passed coupler

- The temperature at the bellows part is more sensitive than the temperature at the ceramic window.
- Normally, the ceramic window temperature is saturated under 320 K with 3.0 kW RF power. With 2.0 kW RF power, the temperature of
- ceramic window is saturated under 310 K.



Figure 14. Test results of non-passed coupler

- Scratch marks are observed at the RF surface of outer conductor.
- Some contaminated marks are found around the ceramic window and inner conductor.
- The RF power level could not increased due to the excessive heat loss at the ceramic window.

Reference

- Heetae Kim. et al., "Control system and experiment for RAON HWR cryomodules", {Proc. LINAC'18}, Beijing, China, 2018, paper THPO097, pp.845-848
- Sangbeen Lee. et al., "Design of RF power coupler for RISP Half Wave resonator", {Proc. IPAC'16}, Busan,







