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RESEARCH AND DEVELOPMENT OF 650 MHZ CAVITIES FOR CEPC

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Abstract

650 MHz 2-cell superconducting cavities are proposed for the main ring of the Circular Electron Positron Collider (CEPC). The design, fabrication, surface treatment (buffered chemical polishing) and vertical tests of the cavities with HOM couplers were conducted. The performance of the cavity at 2 K is not affected by the HOM coupler. The maximum intrinsic quality factor (Q_0) of the cavity with the HOM coupler reached 3.1×10^{10} at 20 MV/m. The vertical test results showed that the fundamental mode external quality factor of all HOM couplers is an order of magnitude larger than quality factor of the cavity. Two 650 MHz 2-cell cavities jacketed have been integrated into a test cryomodule for CEPC. Another 650 MHz 2-cell cavity reached 6×10^{10} at 22 MV/m after nitrogen infusion. In addition, two 650 MHz 1-cell cavities reached 2.7×10^{10} at 35 MV/m (fine grain) and 3.6×10^{10} at 32 MV/m (large grain) after electro-polishing, respectively.



2. Development of 650 MHz 2-cell cavity

Main parameters of 650 MHz 2-cell cavity

| Parameters | Value | Units |
|----------------------------------|-------|-----------|
| Beam tube diameter | 160 | mm |
| R/Q | 211 | Ω |
| G | 279 | Ω |
| E_{peak}/E_{acc} | 2.4 | |
| B_{peak}/E_{acc} | 4.2 | mT/(MV/m) |
| E _{acc} | 22 | MV/m |
| Q ₀ | 4E10 | |
| Q _e of HOM coupler | >4E11 | TM010 |





HPR of the assembled cavity (a), and installation of HOM coupler with cavity (b), and slow pumping of the assembled cavity (c)





Vertical test results of 650 MHz 2-cell cavities



650 MHz 2-cell cavities jacketed