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Research and development of 650 MHz superconducting cavity for CEPC

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The 650 MHz superconducting radio-frequency (SRF) cavities used for the Circular Electron Positron Collider (CEPC) were studied to achieve high accelerating gradient (Eacc) and high intrinsic quality factor (Q0). The 650 MHz single-cell cavities were subjected to a combination of buffered chemical polishing (BCP) and electropolishing (EP), and their Eacc exceeded 40 MV/m. Such a high Eacc may result from the cold EP with more uniform removal. BCP is easy, cheap, and rough, whereas EP is complicated, expensive, and precise. Therefore, the combination of BCP and EP investigated in our study is suitable for surface treatments of mass SRF cavities. Medium temperature (mid-T) furnace baking was also conducted, which demonstrated an ultrahigh Q0 of > 8E10 at 22 MV/m, and an extremely low BCS resistance of ˜ 1.0 nΩ was achieved at 2.0 K. Moreover, nitrogen doping was carried out, which also enhanced Q0 of 650 MHz SRF cavities. This study may benefit SRF community, which has been referenced by PIP II.

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