



Contribution ID: 1831 Contribution code: WEPS22

Type: Poster Presentation

Development of plasma processing for coaxial cavity cryomodules

Wednesday, 22 May 2024 16:00 (2 hours)

Several groups have demonstrated that plasma processing can help to mitigate degradation of the performance of superconducting radio-frequency cavities. Plasma processing provides an alternative to removal of cryomodules from the accelerator for refurbishment. Studies of plasma processing for quarter-wave resonators (QWRs) and half-wave resonators (HWRs) are underway at FRIB, where a total of 324 such resonators are presently in operation. Plasma processing tests were done on several QWRs using the fundamental power coupler (FPC) to drive the plasma. Driving the plasma with a higher-order mode (HOM) shows promise, as it allows for less mismatch at the FPC. Before-and-after cold tests showed a significant reduction in field emission X-rays with judicious application of plasma processing. The first attempt at plasma processing of FRIB QWRs in a cryomodule is planned for December 2023/January 2024. A repeat bunker test of the cryomodule is planned to assess the results.

Footnotes

Funding Agency

Work supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0023633, the State of Michigan, and Michigan State University.

Paper preparation format

LaTeX

Region represented

North America

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Session Classification: Wednesday Poster Session

Track Classification: MC7: Accelerator Technology and Sustainability: MC7.T07 Superconducting RF