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Application of the plasma processing technique to the ELBE SRF gun

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As for all superconducting radio-frequency (SRF) cavities preserving the performance during accelerator operation is even more essential for an SRF gun, because the accelerating field is typically very high and cannot be compensated by a neighboring cavity. One of the main limiting factors remains field emission, that is originating either from particulates or hydrocarbon contaminants on the niobium surface. To remove the latter, plasma cleaning was developed for the Spallation Neutron Source (SNS) at the Oak Ridge National Laboratory as an effective method for mitigating field emitters and increasing the work function of Nb. For elliptical cavities, the method was then adapted by Thomas Jefferson National Accelerator Facility for their 1.5 GHz CEBAF cavities and later further developed by Fermi National Accelerator Laboratory for the 1.3 GHz TESLA design. Since the ELBE SRF gun cavity is also based on an elliptical design with the same resonant frequency, a similar experimental setup was built to adapt the published results to a 3.5-cell test cavity made from reactor grade Nb (RRR40). The contribution will present a detailed description of the plasma processing setup as well as RF simulations and measurements of the 1st and 2nd dipol passband. First plasma ignition was achieved using 100 mbar helium and up to 100 W of RF power but further optimization of the parameter space is needed.

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Yes

Footnotes

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