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Development and Optimization of Plasma Cleaning Process for QWR type Cavities

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Over the years, it has been observed for cavities in operation in accelerators, a continuous degradation of their performance with the appearance or reinforcement of the parasitic field emission phenomenon. This phenomenon, caused by surface pollution promoting the emission and acceleration of electrons by electromagnetic fields, causes the generation of ionizing X radiations. This poses safety problems but also increases the thermal load in the liquid helium bath. This generally involves dismantling the accelerator cryomodule in order to reprocess the accelerating cavities. In recent years, a very promising treatment, applied to the SNS accelerator, for example, allowed to avoid the complete dismantling of faulty cryomodules. This involves generating a reactive plasma by RF excitation of the fundamental mode of the cavity using the RF system already in place. This "in-situ" treatment proves to be very effective in reducing the phenomenon of field emission. In order to reproduce state-of-the-art and optimize the plasma cleaning procedure for QWR cavities, we developed a unique test-bench operating in two modes: 1) sample cleaning, 2) cavity cleaning. Sample mode gives possibility to optimize the efficiency of cleaning depending on the gas composition, pressure, flow, etc⋯. Cavity mode is under investigation and will allow to characterize the plasma cleaning homogeneity depending on several parameters like RF power, frequency and gas mixture.

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