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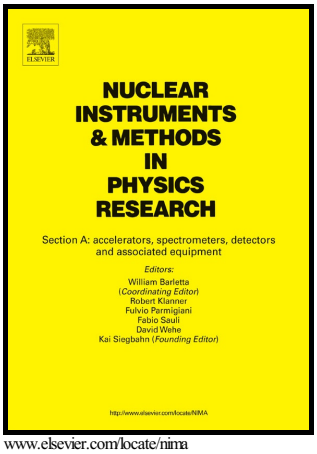

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Operation of a high-gradient superconducting radio-frequency cavity with a non-evaporable getter pump

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Abstract

The use of non-evaporable getter (NEG) pumps in particle accelerators has increased significantly over the past few years because of their large pumping speed, particularly for hydrogen, compared to the size of the pump. A concern about using such pumps in superconducting radio-frequency (SRF) accelerators is the possibility of shedding particulates which could then migrate into the SRF cavities and produce field emission, therefore degrading the cavity performance. One option to mitigate such issue is to use sintered getter materials which intrinsically offer superior mechanical and particle retention properties. In this article we present the results from cryogenic RF tests of a high-gradient SRF cavity after being evacuated several times with an NEG pump equipped with sintered getter disks and placed in close proximity to the cavity. The results showed that the cavity performance was not affected by the pump up to the quench gradient of 34 MV/m. As a result of this study, two such NEG pumps have been installed next to a cryomodule in the CEBAF accelerator to maintain ultra-high vacuum in the SRF cryomodule and two adjacent warm girder sections.

Keywords: superconducting cavities, vacuum pumps, field emission

1. Introduction

Non-evaporable getter (NEG) pumps are a valuable option to achieve and maintain ultra-high vacuum (UHV) in particle accelerators because of their high pumping speed for all getterable gases like H_2, N_2, H_2O, CO/CO_2 and O_2, compact size and ease of operation [1]. NEG pumps are commonly used in particle accelerator, often in combination with ion pumps. Recent examples are in the Swiss-FEL linear accelerator, in the J-PARC accelerator [2], in undulators at Cornell, BNL, Taiwan Photon Source [3] and Spring-8 [4], in a large monochromator chamber at LCLS, in the CLIC Test Facility [5] and ELENA accelerators at CERN [6] and in the beam transport area of the E-XFEL. They are also used in the CEBAF electron gun at Jefferson Lab [7] and in the electron gun for the ERL prototype at Cornell [8]. NEG pumps

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