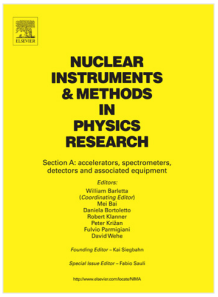
Accepted Manuscript



DC vacuum breakdown in an external magnetic field

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PII: S0168-9002(18)31019-2
DOI: https://doi.org/10.1016/j.nima.2018.08.061
Reference: NIMA 61102

To appear in: *Nuclear Inst. and Methods in Physics Research, A*

Received date : 5 June 2018; Revised date : 20 August 2018; Accepted date : 20 August 2018

Please cite this article as: S. Lebedynskyi, et al., DC vacuum breakdown in an external magnetic field, *Nuclear Inst. and Methods in Physics Research, A* (2018), https://doi.org/10.1016/j.nima.2018.08.061

DC vacuum breakdown in an external magnetic field

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Abstract

The subject of the present theoretical and experimental investigations is the effect of the external magnetic field induction on dark current and a possibility of breakdown. The generalization of the Fowler-Nordheim equation makes it possible to take into account the influence of a magnetic field parallel to the cathode surface on the field emission current. The reduction in the breakdown voltage due to the increment in electron-impact ionization was theoretical predicted. Experimentally shown that the presence of a magnetic field about a tenth as a large as the cutoff magnetic field [18] reduces the breakdown voltage by 10% to 20% for practically all cathodes no matter what their surface treatment.

Keywords: field emission, vacuum breakdown, breakdown rate, magnetic field
PACS: 29.20.Ej, 52.80.Vp, 79.70.+q

1. Introduction

Presently, experiments in particle physics require progressively higher energies, and thus, higher accelerating gradients. Earlier experiments have revealed high-vacuum breakdowns occurring due to energy input by an electromagnetic RF field, providing the accelerating rate of about 100 MV/m [1]. Experiments with accelerating structures of a prototype compact linear collider (CLIC) showed the advent of breakdowns when such gradients were tested. Therefore the acceleration could not be provided along the full length of the collider [2]. And to achieve the required electron- and positron energies of 3 TeV did not

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