Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, January 27-th, 2009

(16:00 in Room 459/30b)

Suppressing the Enhanced Field Emission from Nb Surfaces

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Abstract

The onset of field emission (FE) at high fields imposes one major limitation for superconducting Niobium (Nb) accelerator structures. Field emission is mainly caused by the presence of irregularities or impurities on the cavity surface. The improved surface preparations and cleaning techniques have been found to suppress FE. For systematic investigations, we have measured various broad area copper and niobium cathodes by means of a DC field emission scanning microscope. The samples were treated with high pressure rinsing and dry-ice cleaning at intermediate steps of the measurements. The cleaning effect on the emitting sites was investigated up to fields of 250 MV/m. The microscopy results prove the effective removal of field-emitting particulates down to 400 nm as well as the partial smoothing of surface protrusions after dry-ice cleaning. High purity single-crystal and large grain Nb with different surface preparations were measured before and after a low temperature heat treatment in high vacuum. The results show the evidence of grain boundary assisted FE at very high fields. An interesting correlation between sizes of all investigated emitters derived from SEM images with respect to their onset fields has been found, which might facilitate the quality control of superconducting radio-frequency cavities for linear accelerators.

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