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The electric breakdown phenomena in accelerator design - numerical studies

Many high electric field applications, like as CERN's Compact Linear Collider, are severely hampered by the occurrence of electrical breakdowns. Electrical discharge arises in the presence of a sufficiently high applied electric field, even at ultra high vacuum circumstances, causing disturbances in the device's operating regime, material damage, and, in general, limiting the device's operation severely. The phenomenon itself has been known for a long time, but its precise initiation mechanisms remain a mystery. According to current hypotheses, electric field effect causes the creation of field augmenting nanoscale tips. This tip will cause large field emission currents, netural atom evaporation, plasma development, and, finally, full electrical breakdown. In this talk, we investigate the hypotheses of the initiation mechanisms of field emitters, through investigations conducted with nanoscale materials subjected to high fields utilizing the multi-physics-multi scale modeling framework FEMOCS calculations. We present the latest developments of FEMOCS and discuss fields of application in additional experiments like FCC.

Type of contribution

Talk

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