FDTD-PIC MODELING FOR INITIATION OF VACUUM INSULATOR FLASHOVER

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Vacuum insulators are necessary components in many pulsed power systems. They provide mechanical support as well as separate vacuum and non-vacuum regions. Unfortunately, the surface of the insulator is often the weakest part of a system. Surface flashover can occur for electric field values much lower than bulk breakdown through the material. It is important to develop models that can be used to optimally design insulators under different operating conditions and reliably predict when flashover will occur. Although many theories and a lot of empirical data can be found in the literature, there are few, if any, good models available. In this presentation we will discuss results of FDTD-PIC simulations for initiating vacuum insulator flashover.

Using the VORPAL[1] code on Linux clusters at LLNL we have previously investigated many phenomena important to the initiation of insulator flashover[2]. The physics investigated includes field distortion due to the dielectric, field emission, low energy secondary emission, insulator charging, and magnetic fields. We have recently included the effects of a thin gas layer next to the surface of the insulator. The electrons can ionize the gas if they have the right energy. Including these different effects in a self-consistent simulation leads to a better understanding of vacuum insulator flashover and closer to a predictive model.

1. Tech-X Corporation, 5621 Arapahoe Ave., Suite A, Boulder CO, 80303, http://www.txcorp.com..
2. M.P. Perkins, T.L. Houck, J.B. Javedani, G.E. Vogtlin, and D.A. Goerz, "Progress on Simulating the Initiation of Vacuum Insulator Flashover," 17th IEEE Pulsed Power Conf. 2009, p. 441.

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