ELECTRICAL BREAKDOWN PHENOMENA INVOLVING MATERIAL INTERFACES

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Material interfaces often reveal complicated and interesting phenomena and physics during electrical breakdown. In this talk, the physics at interfaces in two specific applications will be discussed. One involves the insulator-electrode interface of photoconductive semiconductor switch (PCSS) devices. Another is the air-dielectric interface found in many electrical breakdown phenomena, such as lightning arresters. In this case, the role of high dielectric permittivity in initiating breakdown will be a focus. The physics to be described will be examined in a series of transport calculations in which avalanche breakdown of solids and gases is included. These continuum calculations produce information such as the time-resolved electron, hole and ion densities following switch triggering by an overvoltage or radiation. The results will be used to examine the initial breakdown phenomena, such as thermionic and field emission at the interface, during the start of breakdown caused by an overvoltage. In addition, phenomena, such as Auger recombination, that are involved in charge collection and electrode will be included in these calculations. Finally, thermal breakdown along an air-insulator interface will be described in relation to experiments that reveal breakdown that "hugs" such an interface. These illustrative calculations will be compared with data.

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