SIMULATION OF ELECTRIC CURRENT IN PHOTOCONDUCTIVE SEMICONDUCTOR SWITCHES

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Optically-triggered, high-power photoconductive semiconductor switches (PCSS's) using semi-insulating GaAs are under development at Sandia. These switches carry current in high carrier-density filaments. The properties of these filaments can be explained by collective impact ionization theory in which energy redistribution by carrier-carrier scattering within the filament enhances the impact ionization. This allows these filaments to be sustained by fields which are relatively low compared to the bulk breakdown fields. For GaAs, the sustaining field is approximately 4.5 kV/cm. For this talk, a hydrodynamic implementation of the collective impact ionization theory is used to compute the temporal evolution of these filaments following optical triggering. These continuum calculations are based on previous calculations in which the steady-state properties of filaments are computed using a Monte Carlo method to solve the Boltzmann equation. The effects of carrier recombination at defects will also be discussed in the presentation of the results.