

IMPROVED CONTACT DESIGN FOR THE SiC PHOTO-SWITCH USED IN HIGH POWER APPLICATIONS

Christopher M. Fessler

Dr. William C. Nunnally, Thesis Supervisor

ABSTRACT

Silicon Carbide (SiC) has a bulk dielectric strength of 3000 kV/cm, thermal conductivity of 4.9 W/(cm-K), and high tensile strength. It is considered the most promising photo-switching material that can enable the fielding of the most compact pulse power systems. The SiC photo-switch as an advantage over other high power switches when it is operated at a high blocking electric field. Presently, the field blocking performance of the SiC photo-switch has fallen short of the theoretical expectations. Breakdown occurs prematurely at an applied electric field of ~ 300 kV/cm not at the expected 3000 kV/cm. Breakdown is not due to the SiC bulk material but to electric field enhancement caused by the switch packaging. No packaging method exists to effectively address electric field crowding at the point where the electrode leaves the SiC bulk. At this triple point junction, the induced electric field exceeds the bulk dielectric strength of the SiC. Without an improved package, the potential of the SiC photo-switch may not be realized. Reported in this paper is a novel concept of inserting contoured electrodes into the SiC bulk to minimize field crowding in order to improve the breakdown characteristics. The concept is simulated, a fabrication process is designed, and the first steps to the fabrication process are tested.