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Dynamic Degradation Mechanism of SiC VDMOS under Proton Irradiation

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Abstract : The effects of proton irradiation on the properties of gate oxide were evaluated by monitoring the static parameters (such as threshold voltage and on-resistance) and dynamic parameters (Miller plateau time) of 1700V SiC VDMOS before and after proton irradiation. The incident proton energy was 3MeV, and the doses were 5×10^{12} P / cm^2, 1×10^{13} P / cm^2, respectively. The results show that the threshold voltage of MOS exhibits negative drift under proton irradiation, and the near-interface traps in the gate oxide layer are occupied by holes generated by the ionization effect of irradiation, thus forming more positive charges. The basis for selecting TMiller is that the change time of Vgs is the time when Vds just shows an upward trend until it rises to a stable value. The degradation of the turn-off time of the Miller platform verifies that the capacitance Cgd becomes larger, reflecting that the gate oxide layer is introduced into the trap by the displacement effect caused by proton irradiation, and the interface state deteriorates. As a more sensitive area in the irradiation process, the gate oxide layer will be optimized for its parameters (such as thickness, type, etc.) in subsequent studies.

Keywords : SiC VDMOS, proton radiation, Miller time, gate oxide
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