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Fabrication and characterization of SiC UV Schottky photodiodes

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There is an increasing demand for ultraviolet (UV) photodetectors in many fields such as ecology, medicine and military. SiC is a good candidate for visible-blind UV detectors due to its wide bandgap (6H-SiC : 3.0 eV, 4H-SiC : 3.2 eV), and relatively low absorption coefficient at UV region ($1.33*10^3$ cm^{-1} at λ=325 nm) makes SiC more attractive choice than other wide band-gap materials such as GaP and GaN. Devices were fabricated on 2 inch N-doped 6H-SiC wafers purchased from SiCrystal AG and 4H-SiC wafers from Cree Inc. 7.5nm-thick semitransparent Pt films were deposited by e-beam evaporation to form Schottky contact. To enhance UV absorption, part of the Pt films was removed by lift-off technique. To improve the adhesion between metal and SiC and to release the stress developed during thin metal film deposition, low temperature annealing was performed after Schottky contact formation and pad metal (Ti/Au) deposition. Fabricated diodes showed uniform electrical characteristics, but their electrical parameters (Schottky barrier height, ideality factor) significantly deviated from the ideal values. The origin of this deviation was attributed to overetching of field oxide and subsequent formation of unwanted Ti/SiC contact. Ti/SiC contact possesses lower Schottky barrier height than Pt/SiC contact, and formation of the Ti/SiC contact around the oxide window lowered Schottky barrier height of the entire diode. Barrier height inhomogeneity by unexpected Ti/SiC contact is thought to degrade the ideality factor of the diode. Relative responsivity measurement revealed that the dominant factor for the wavelength at which photoresponse shows the maximum value is not the dimension of the removed Pt films but the thickness of the low-doped epilayer.