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SUPPORTING INFORMATION

Effects of spontaneous nitrogen incorporation by a 4*H*-SiC(0001) surface caused by Plasma Nitridation

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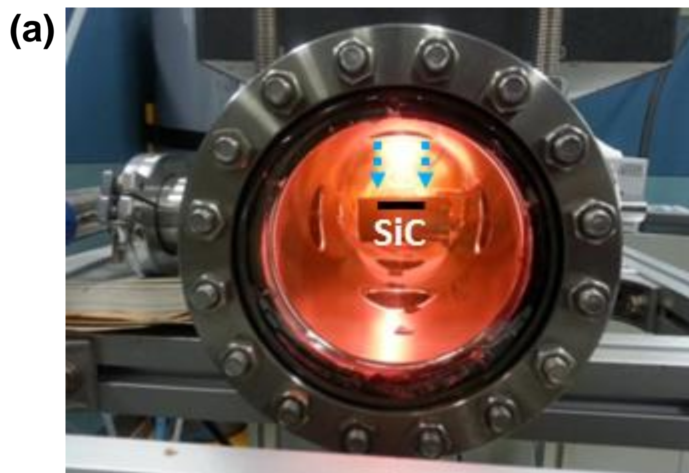


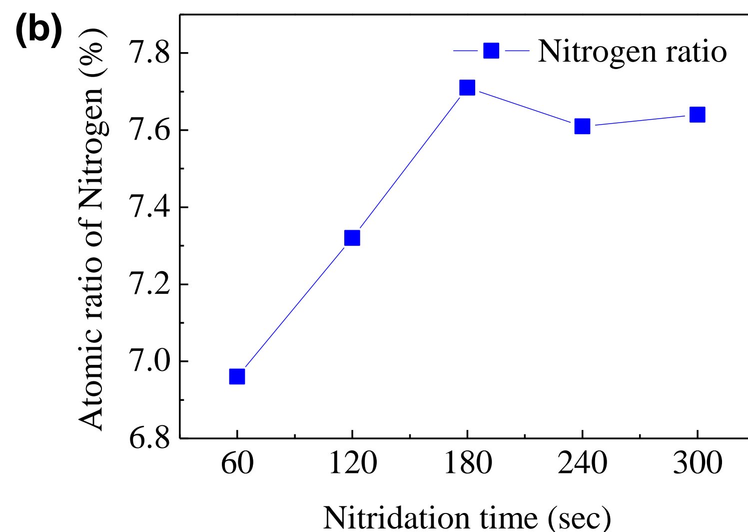


Figure S1. (a) image of Plasma Nitridation (PN) process, Nitridation was performed at room temperature for 180 s under a 1000 sccm N_2 gas (ignition Ar, 10 s, working pressure 1 Torr) and plasma power 4100 – 4300 W, (b) Nitrogen ratio as a function of nitridation time, nitrogen saturation time calibrated by XPS (at 180 s).

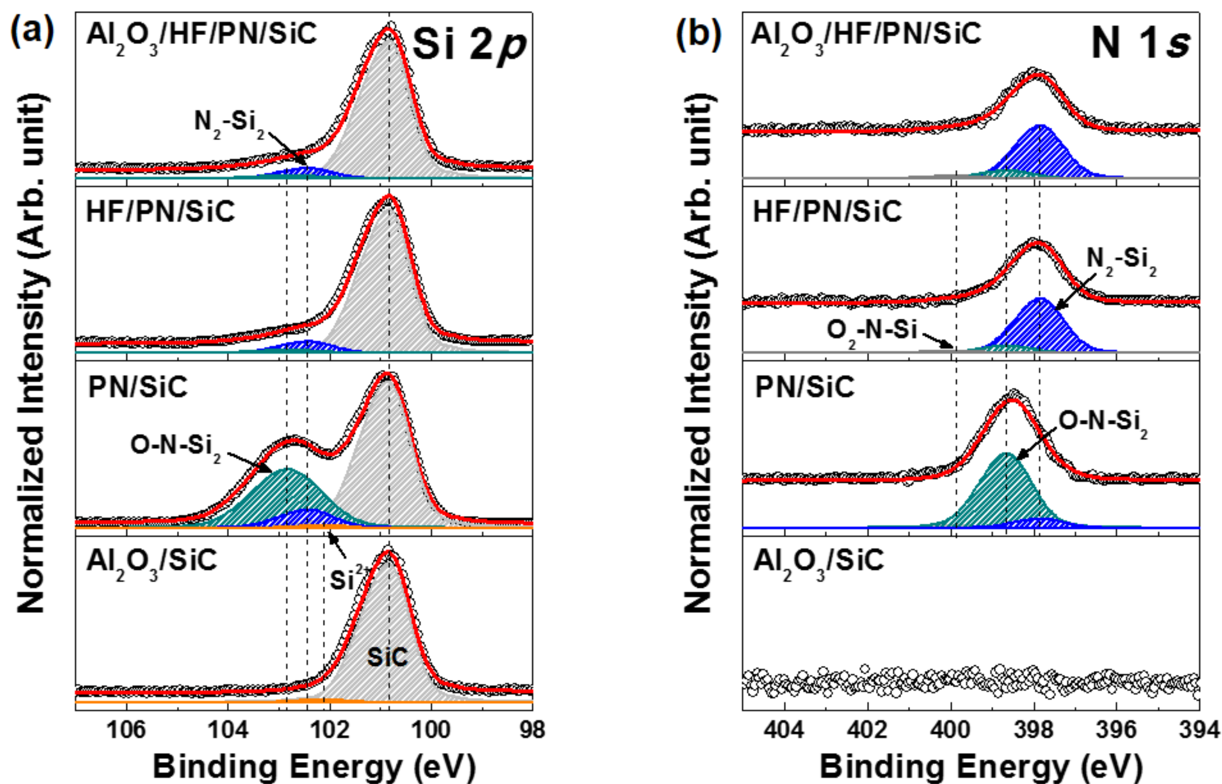
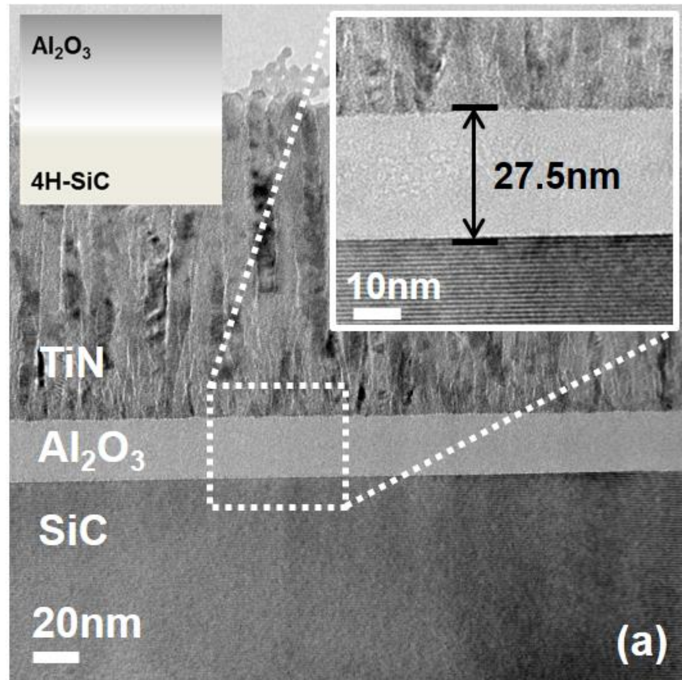


Figure S2. (a) XPS Si 2*p* and (b) N 1*s* core-level spectra Al_2O_3(2 nm)/SiC, PN/SiC, HF/PN/SiC and Al_2O_3(2 nm)/HF/PN/SiC. In the Si 2*p* and N 1*s* spectra, The spectra show that a significant amount of nitrogen atoms remains (Si−N, Si-O-N perfect bonds) in the Al_2O_3 (2 nm)/HF/PN/SiC after the unstable oxide is removed by a selective etching process using HF.



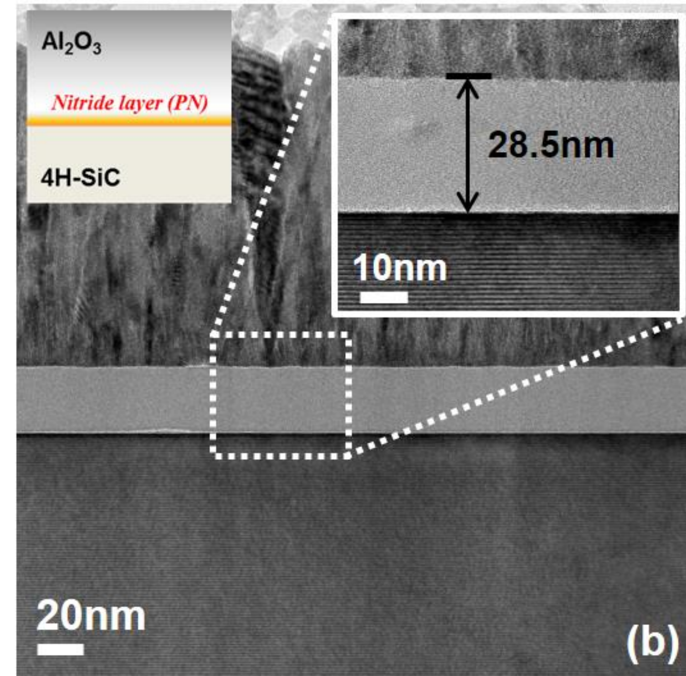


Figure S3. Cross-sectional HRTEM images of the (a) Al_2O_3/SiC and the (b) Al_2O_3/PN/SiC substrate after ALD-Al_2O_3 (30 nm) and TiN metal gate deposition. The J-E curve of electric field (MV/cm) was calculated by the thickness of dielectric layers and gate voltage (V_g).

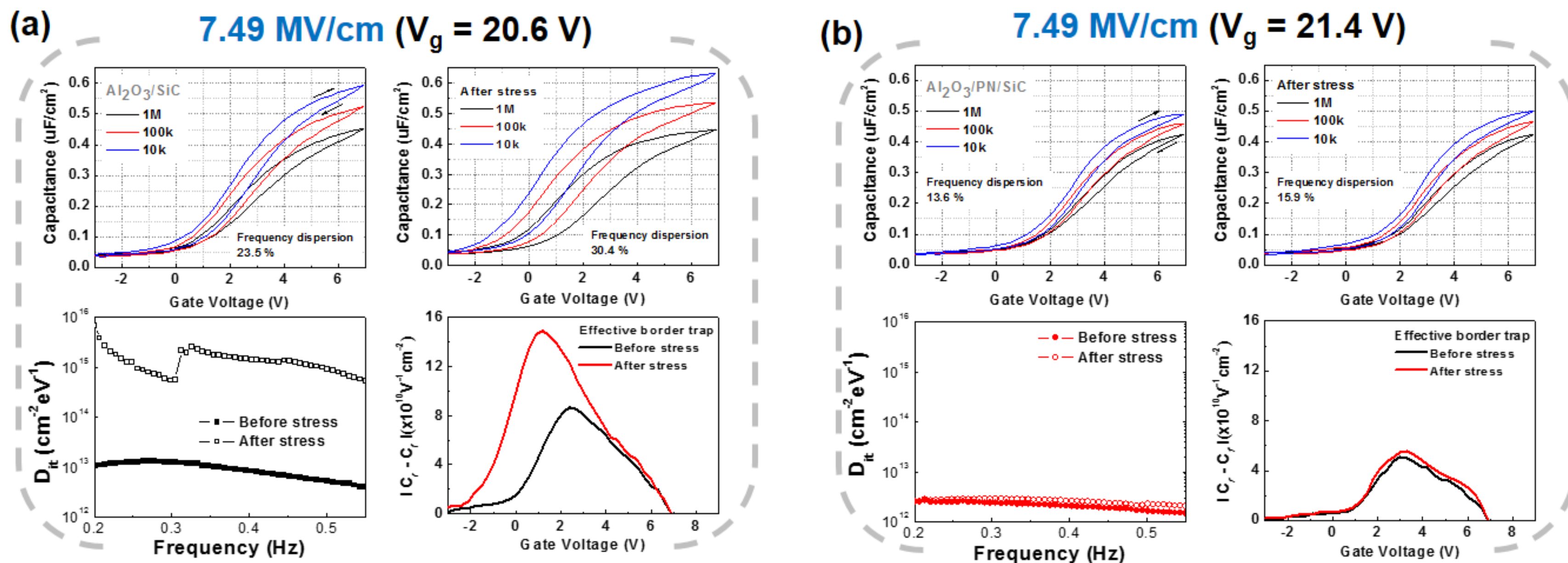


Figure S4. The stress field (MV/cm) and gate voltage (V_g) were calibrated by dielectric thickness (figure S3), (a) Al_2O_3/SiC (7.49 MV/cm, V_g = 20.6 V) and (b) Al_2O_3/PN/SiC (7.49 MV/cm, V_g = 21.4 V), respectively. The results of defect states (frequency dispersion, D_{it} and border trap density) was significantly suppressed in Al_2O_3/PN/SiC by the PN treatment of SiC at the same electric field (7.49 MV/cm).