Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Scalable Graphene Synthesized by Plasma-Assisted Selective Reaction Process on Silicon Carbide for Device Application

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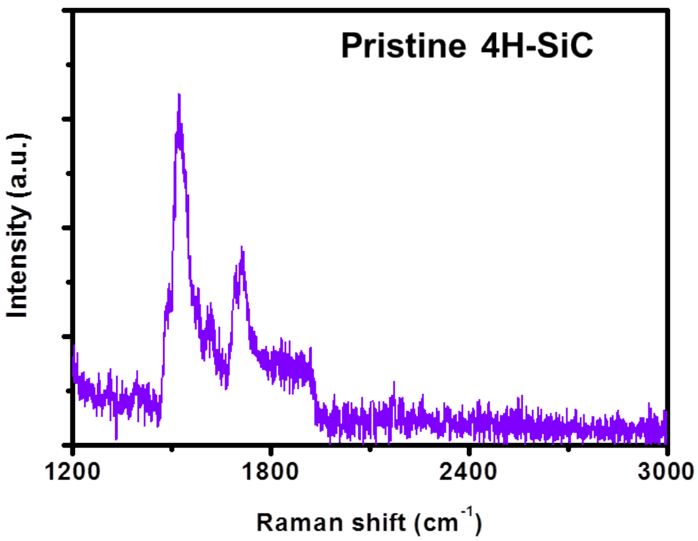
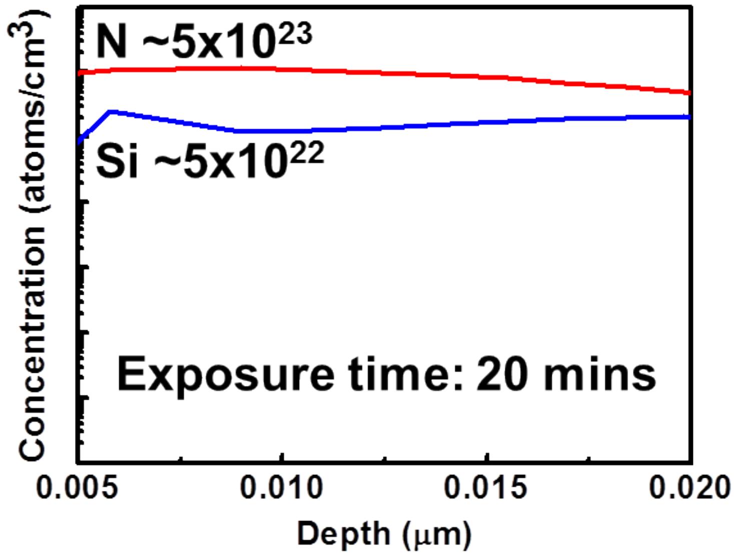
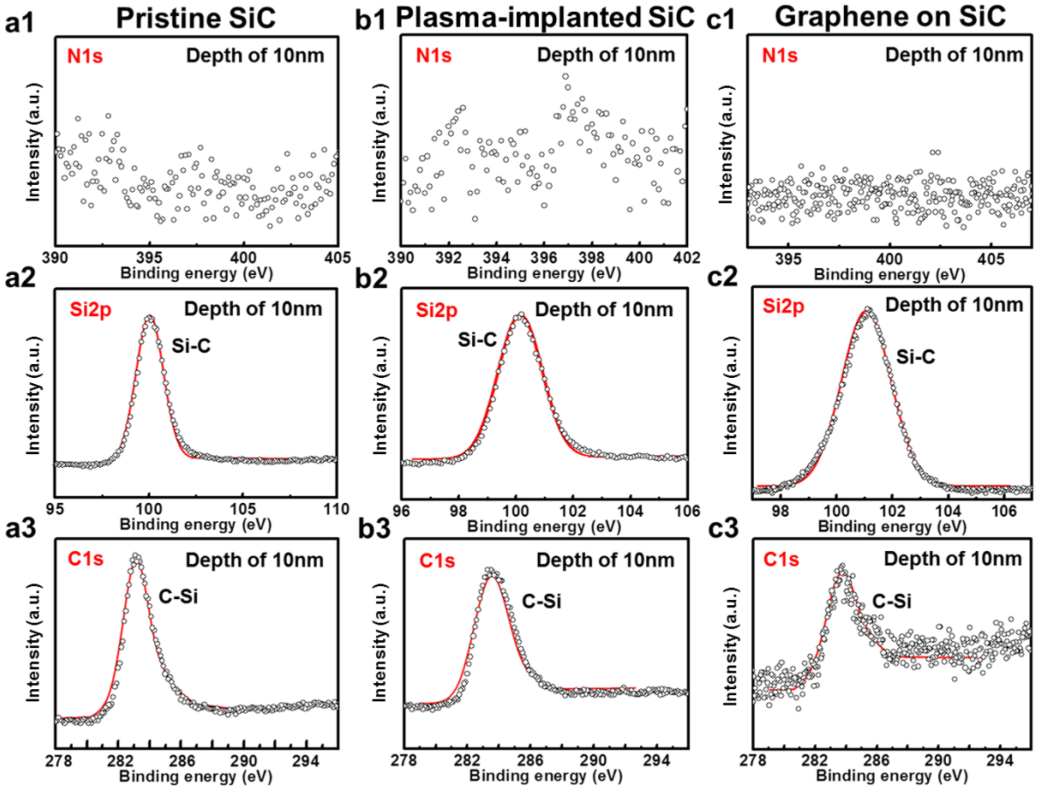


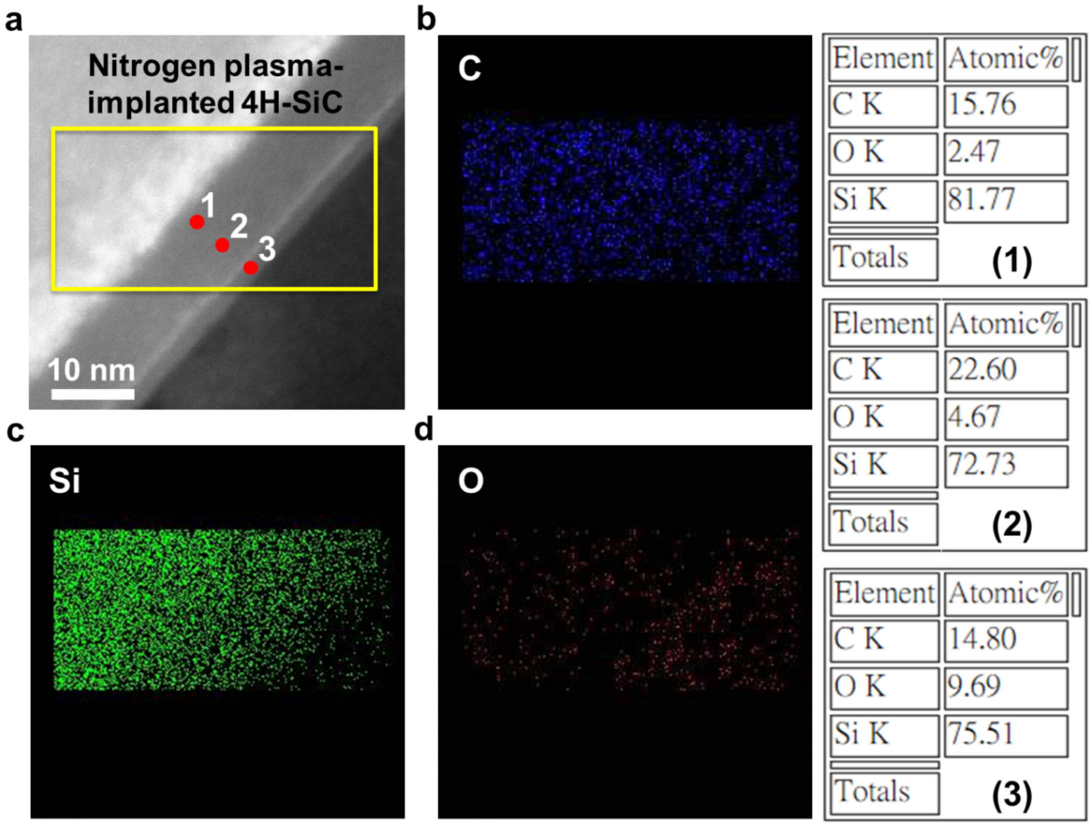
Supplementary Figure 1 Raman spectrum. Raman spectrum of pristine 4H-SiC.



Supplementary Figure 2 SIMS depth concentration profile. The depth concentration of nitrogen in Si substrate.



Supplementary Figure 3 XPS spectra of 10 nm-depth below the surface. a, N1s (a1), Si2p (a2), and C1s (a3) spectra of pristine SiC. **b,** N1s (b1), Si2p (b2), and C1s (b3) spectra of plasma-implanted SiC. **c,** N1s (c1), Si2p (c2), and C1s (c3) spectra of graphene on SiC.



Element	Atomic%
C K	15.76
O K	2.47
Si K	81.77
Totals	

(1)

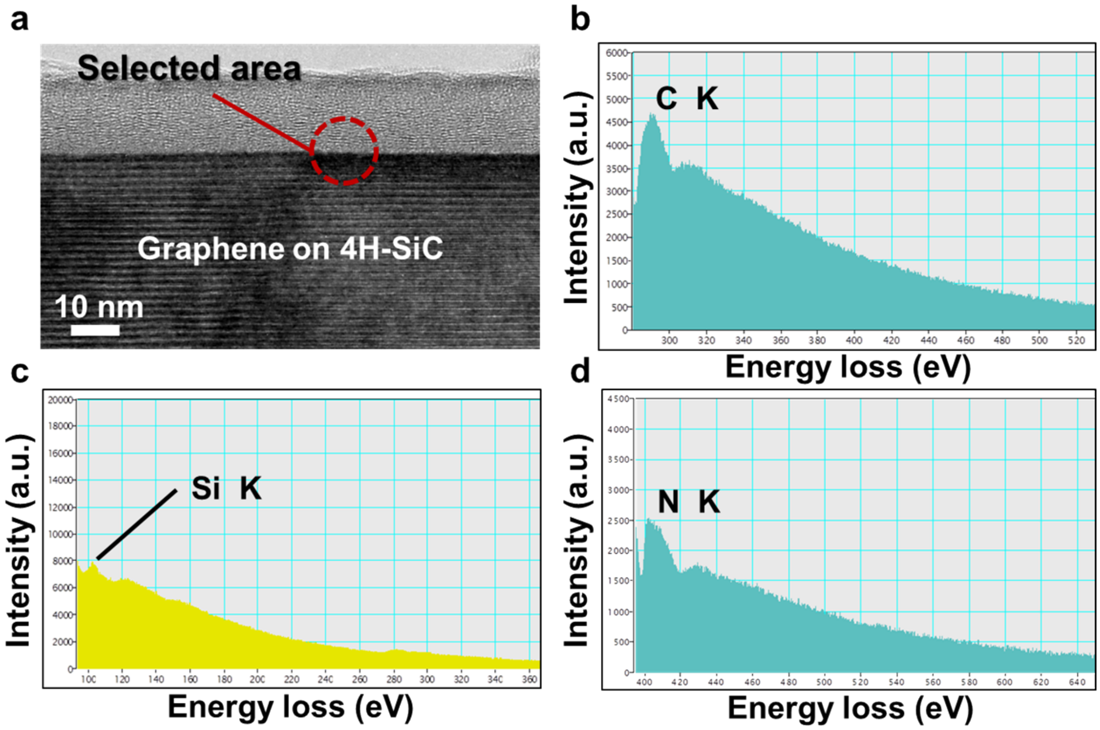
Element	Atomic%
C K	22.60
O K	4.67
Si K	72.73
Totals	

(2)

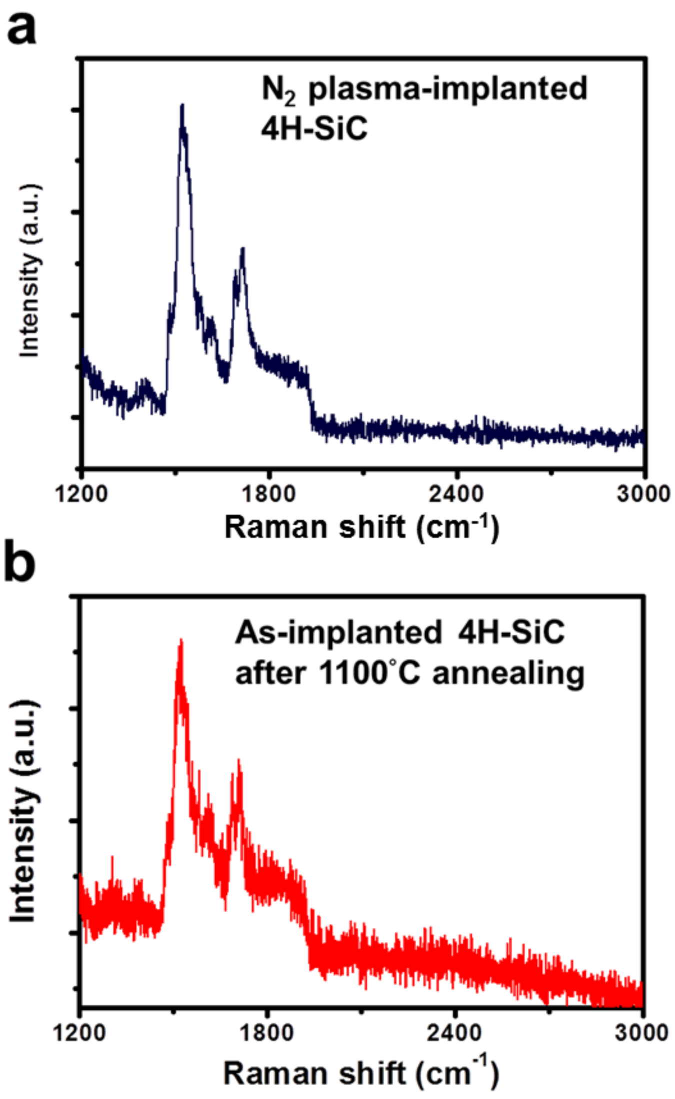
Element	Atomic%
C K	14.80
O K	9.69
Si K	75.51
Totals	

(3)

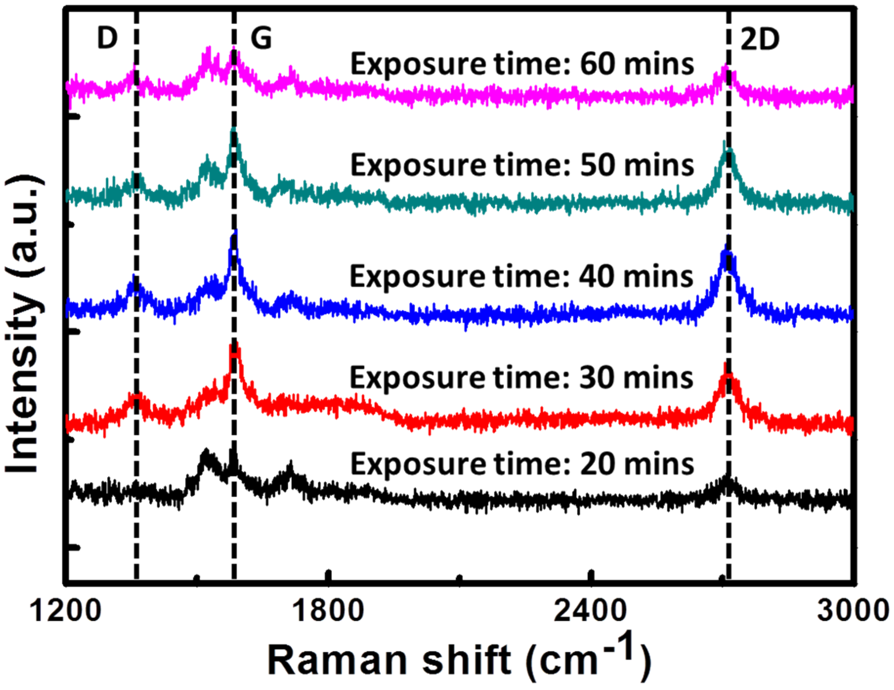
Supplementary Figure 4 TEM observation and EDS mapping. a, Cross-sectional TEM image of plasma-implanted SiC and the red dots indicate the depth of EDS line-scan. **b,** C EDS mapping of the area within yellow frame in **a**. **c,** Si EDS mapping of the area within yellow frame in **a**. **d,** O EDS mapping of the area within yellow frame in **a**.



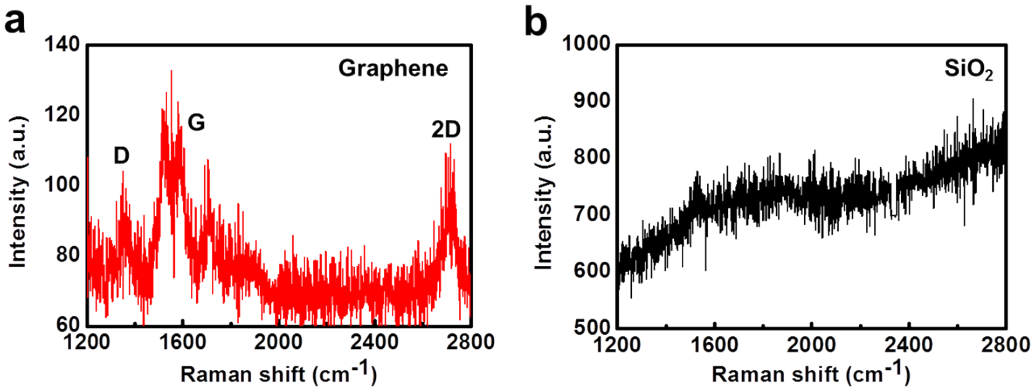
Supplementary Figure 5 TEM observation and EELS spectra. a, Cross-sectional TEM image of graphene on SiC and the red circle indicates the selected area. **b,** C K-edge EELS spectrum of the region within red circle in **a**. **c,** Si K-edge EELS spectrum of the region within red circle in **a**. **d,** N K-edge EELS spectrum of the region within red circle in **a**.



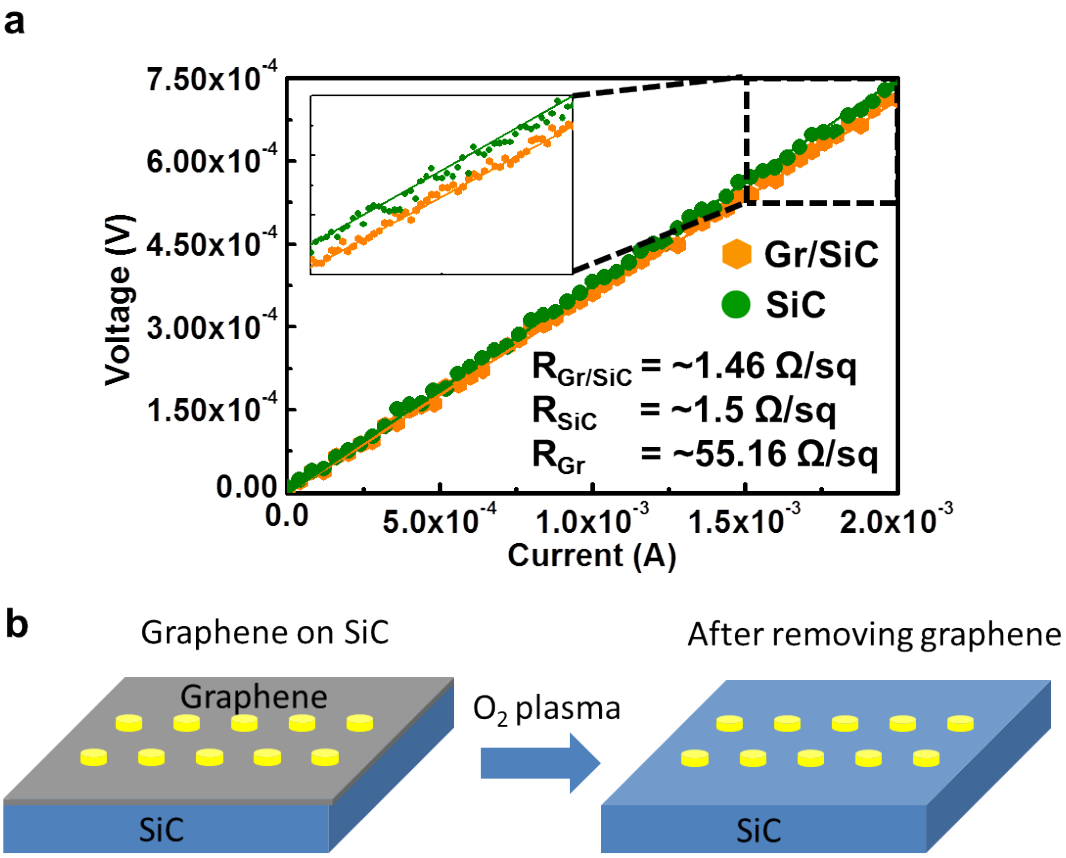
Supplementary Figure 6 Raman spectra. a, Raman spectrum of plasma-implanted 4H-SiC. **b,** Raman spectrum of plasma-implanted 4H-SiC after 1100°C annealing.



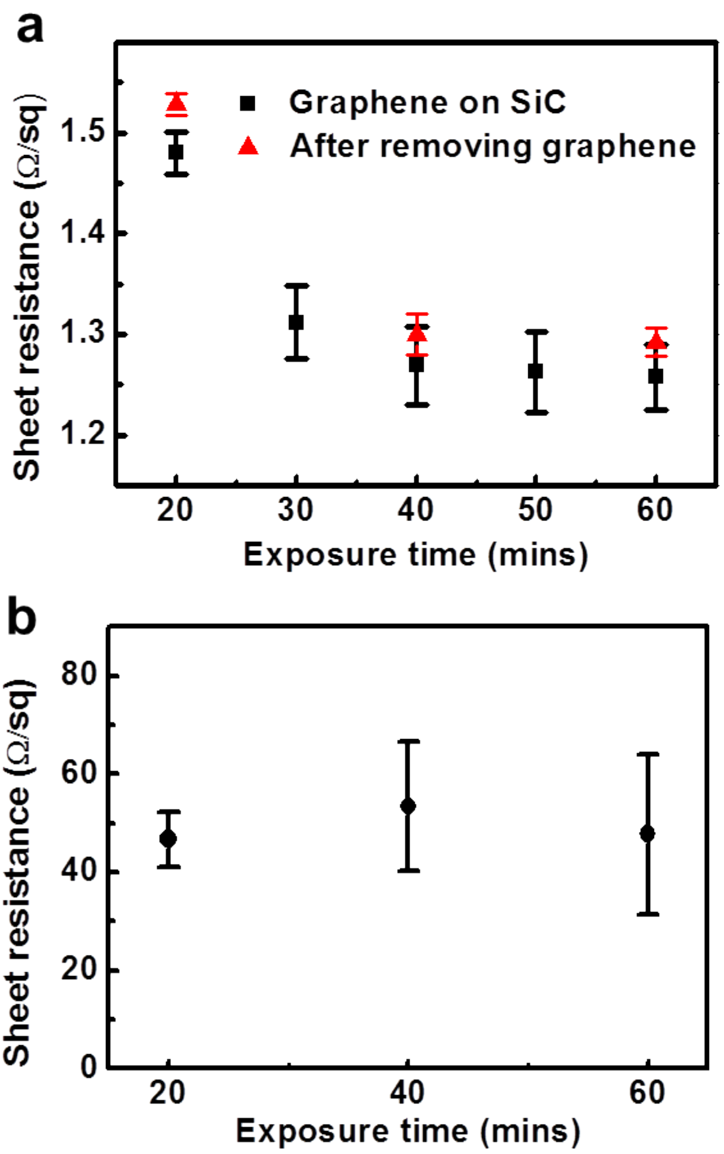
Supplementary Figure 7 Raman spectra. Raman spectra of graphene obtained by PSR process with different plasma exposure times.



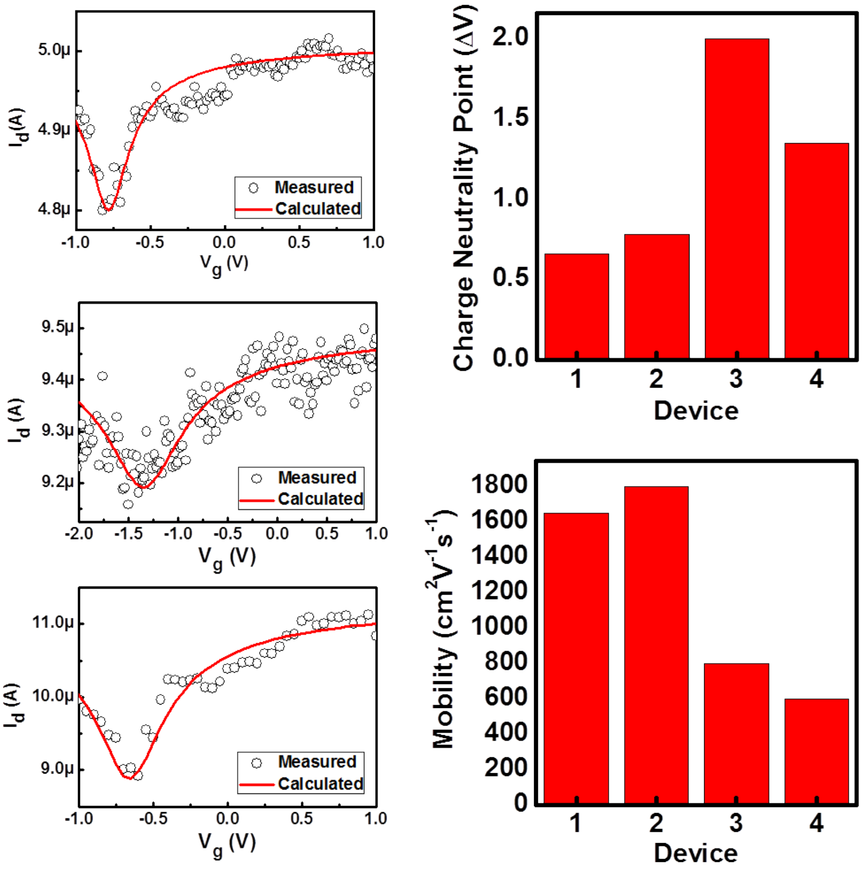
Supplementary Figure 8 Raman spectra. a, Raman spectrum of patterned graphene on SiC. **b,** Raman spectrum of patterned SiO_2 on SiC.



Supplementary Figure 9 Four-probe measurement. a, I-V behavior of graphene on SiC and pure SiC after removal of graphene. **b,** schematic of the process for removing graphene.



Supplementary Figure 10 Sheet resistance. a, sheet resistances of SiC after the PSR process with different plasma exposure times before and after removal of graphene. **b**, Estimated sheet resistances of graphene films extrated from **a.**



Supplementary Figure 11 Device characteristics. I_{ds}-V_g behavior of graphene FETs on SiC and the statistical results of mobility and charge neutrality point.