Supplementary Materials

Electrical tailoring of the photoluminescence of silicon-vacancy centers in diamond/silicon heterojunctions

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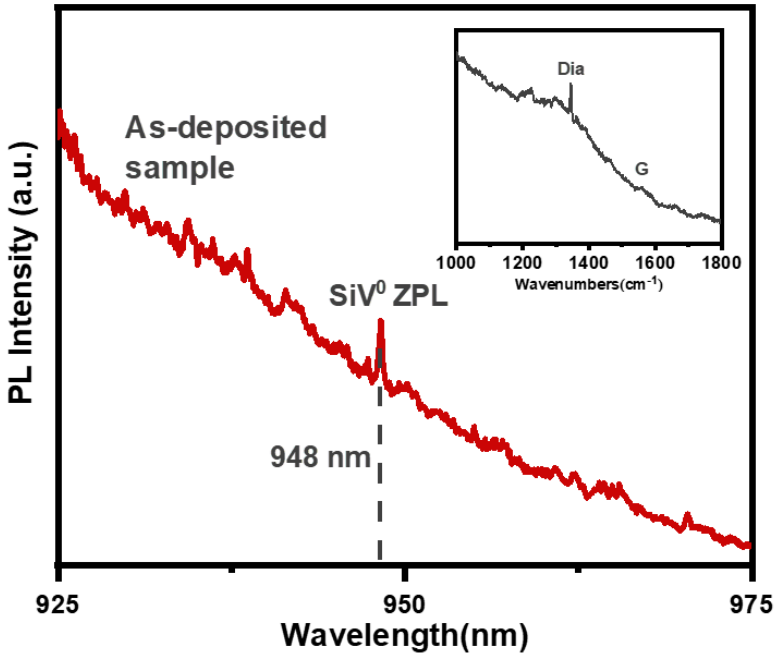

Figure S1. The PL spectrum of the as-deposited diamond film excited by a 785 nm laser at liquid nitrogen temperature (77 K). A clear peak located at 948 nm indicates the presence of neutrally-charged SiV^0 centers. The inset shows the Raman spectra of the diamond film under the same excitation laser.

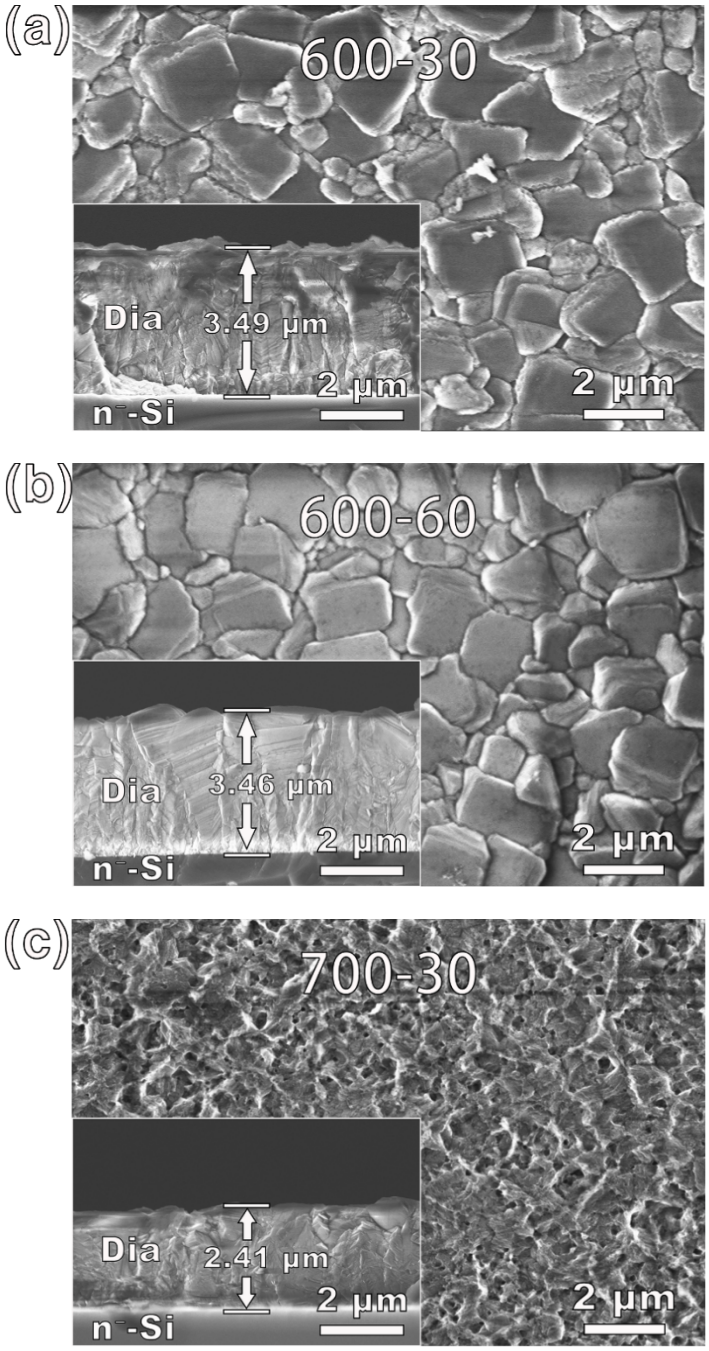

Figure S2. The SEM images of the diamond films annealed at various temperatures and durations: (a) 600°C-30 min; (b) 600 °C-60 min; (c) 700 °C-30 min.

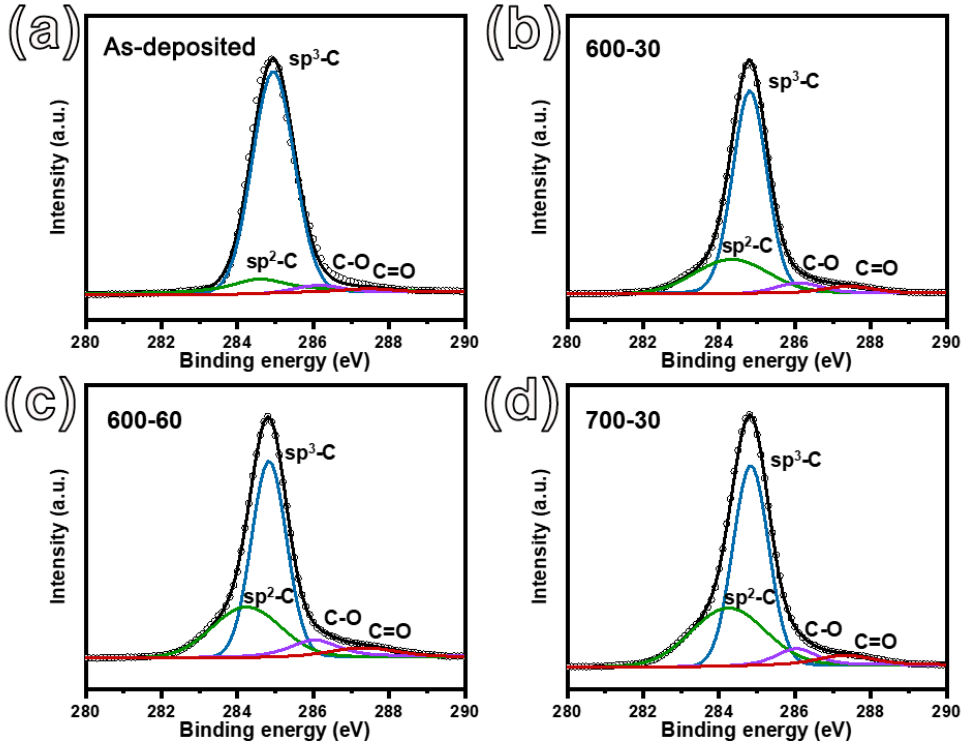

Figure S3. XPS spectra of the C1 core carbon of the as-deposited samples before and after air annealing treatment: (a) the as-deposited sample; (b) the 600-30 sample; (c) the 600-60 sample; (d) the 700-30 sample. Due to the insulting nature of diamond, all the spectra are calibrated by aligning the sp^3 C-C peak to the known literature value of 284.8 eV.

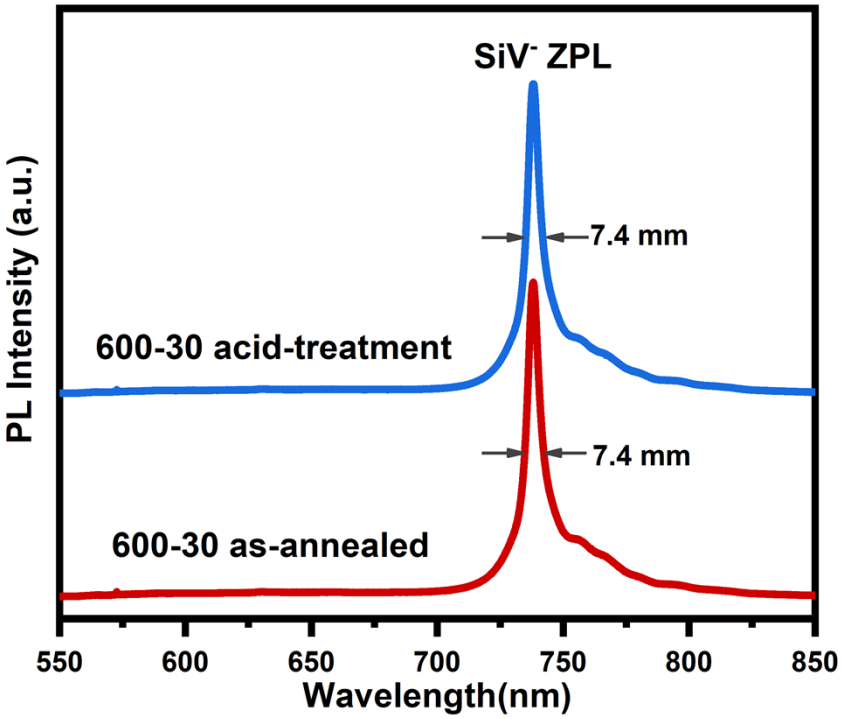

Figure S4. The PL spectra of the as-annealed sample before and after acid treatment. In this process, the as-annealed (600-30) sample was soaked in mixed acid (H_2SO_4: HNO_3 = 3:1) at a temperature of 130^{o}C for 120 min, in order to etch the surface sp^2-C introduced in the annealing process. The PL result clearly shows that the surface graphitization plays a negligible role on the PL intensity of SiV^- centers in the whole depth.

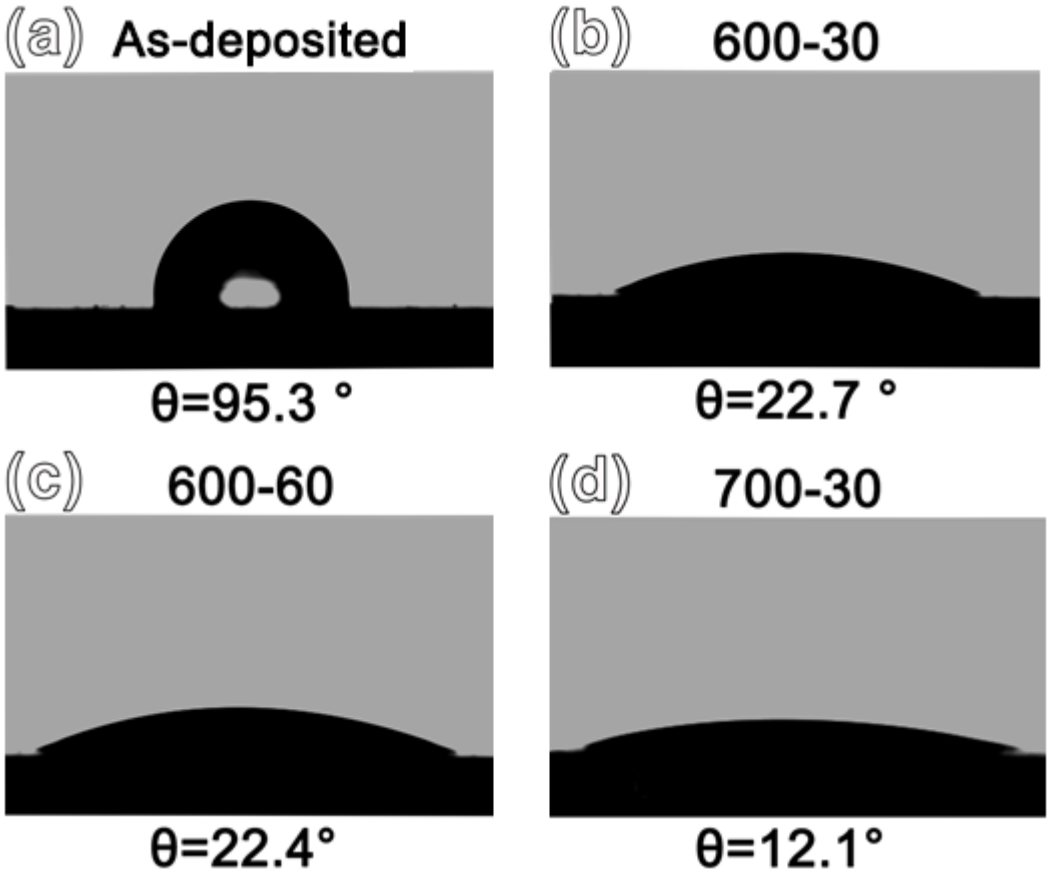

Figure S5. The water contact angle of the as-deposited samples before and after air annealing treatment: (a) the as-deposited sample; (b) the 600-30 sample; (c) the 600-60 sample; (d) the 700-30 sample.

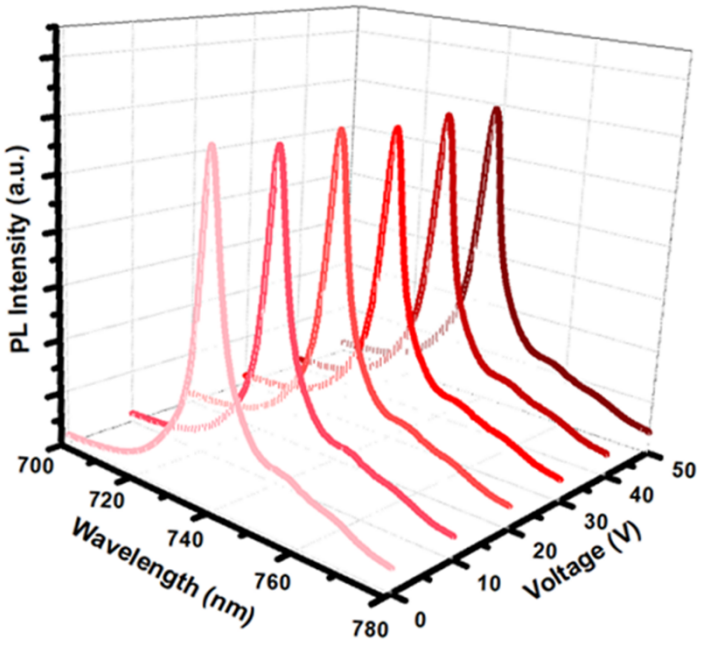

Figure S6. The PL signals collected at the region about 2 mm away from the electrodes with applying bias voltages on the diamond/ n^+-Si heterojunction.

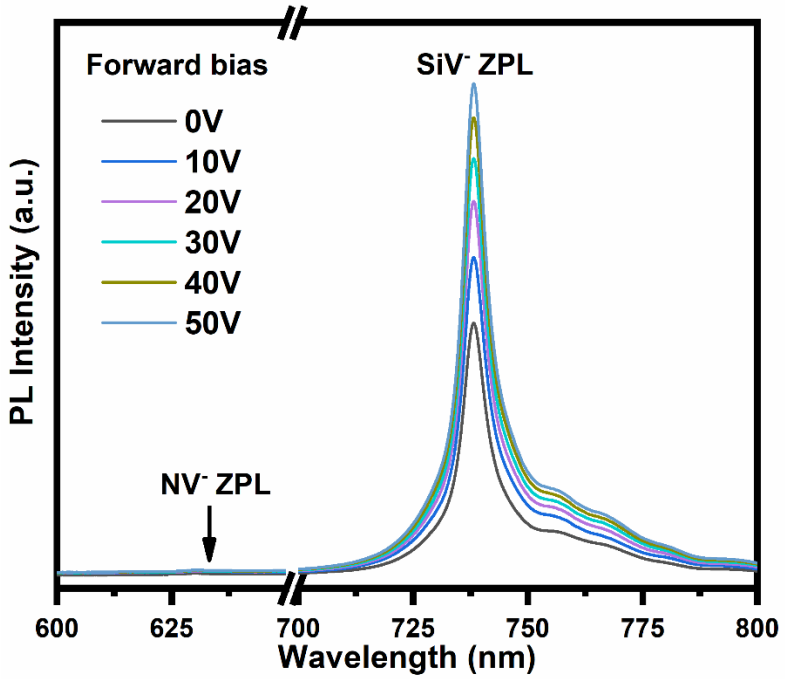

Figure S7. The PL spectra of the diamond/n^+-Si heterojunctions at different forward bias voltages.

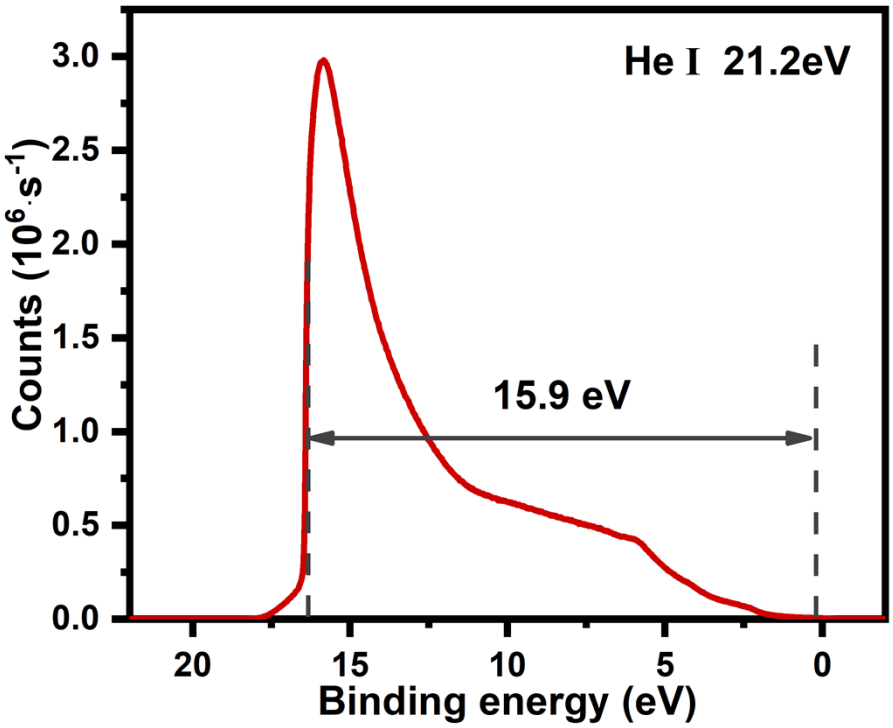

Figure S8. UPS valence band spectrum of the as-deposited H-terminated diamond film, exhibiting the energy difference from vacuum level (E_{VAC}) to valence band maximum (E_V) is estimated to $21.2\ eV - 15.9\ eV = 5.3\ eV$. The electron affinity of diamond (χ) was derived by: $\chi = E_{VAC} - E_C = E_{VAC} - E_V - E_g^{dia} = 5.3 - 5.47 = -0.17\ eV$. All energies are measured relative to the common Fermi level that is determined from a reference gold foil.