Supplementary Information for

Facile controlled growth of multilayer h-BN thin films using spaced-confined APCVD and its gate dielectric application

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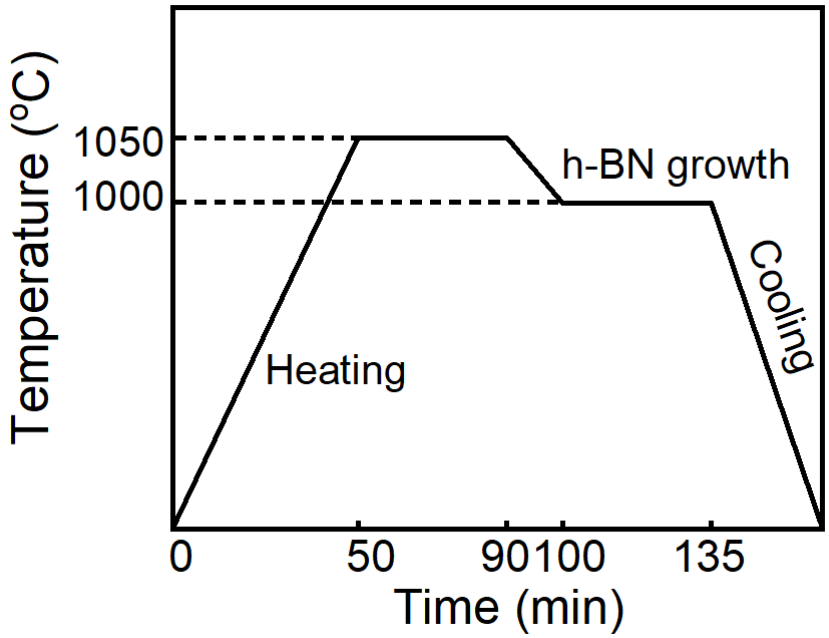

Fig. S1 Temperature profile of APCVD growth.

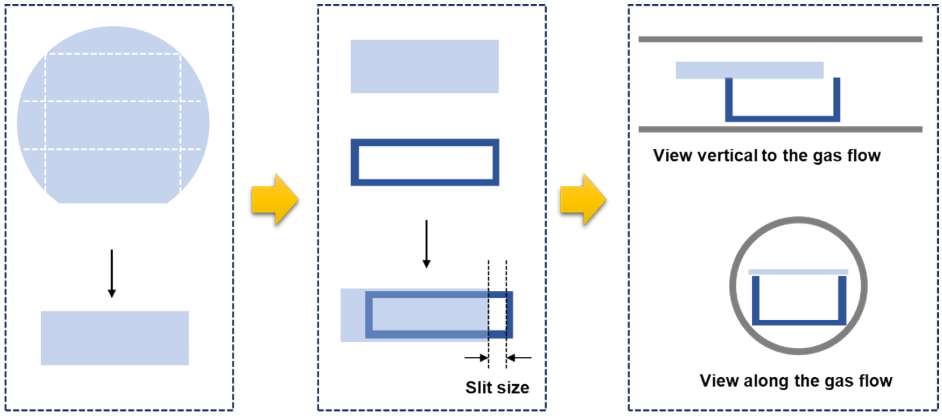

Fig. S2 The procedures for constructing a confined growth space with a determined silt size.

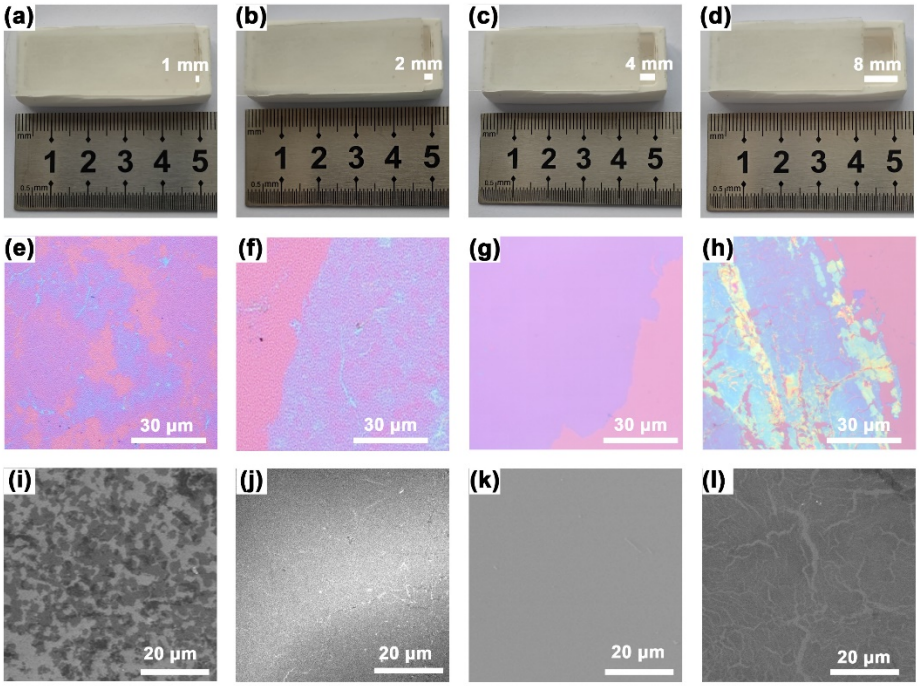

Fig. S3 The influence of slits on the growth of multilayer h-BN. (a-d) Photographs of ceramic boat with narrow slits of (a) 1 mm, (b) 2 mm, (c) 4 mm, and (d) 8 mm. (e-h) and (i-l) are corresponding optical images and SEM images, respectively.

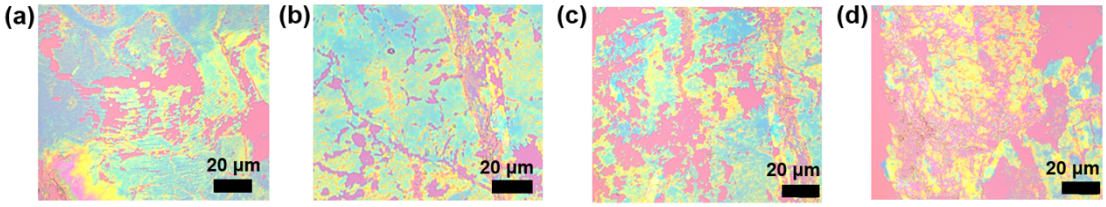

Fig. S4 Effect of the heating temperature of $(NH_4)_2CO_3$ on the growth of h-BN thin films. (a) – (d) are optical images of the transferred h-BN thin films on SiO_2/Si grown under the heating temperature of 60, 70, 80, and 90 ^oC.

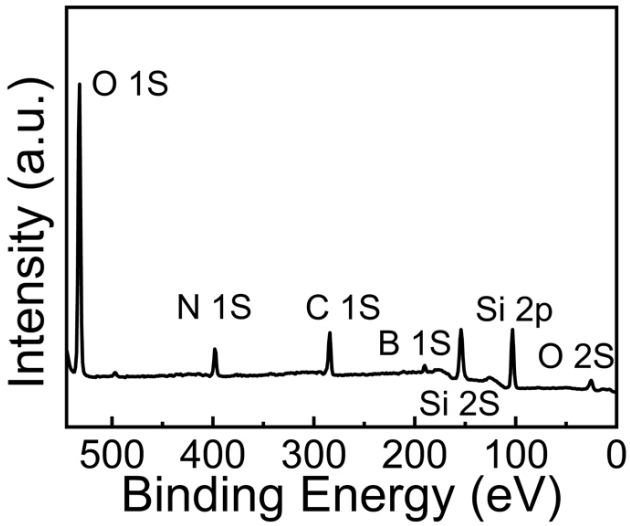

Fig. S5 XPS full spectrum of h-BN thin films transferred onto SiO_2/Si substrate.

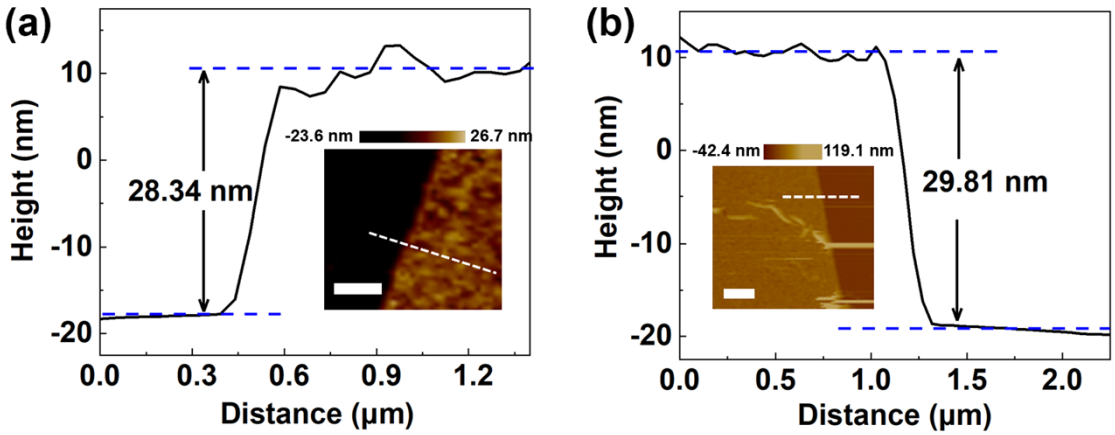

Fig. S6 h-BN thin film grown in open space. AFM of h-BN grown at the temperature of (a) 800 °C and (b) 1050 °C.

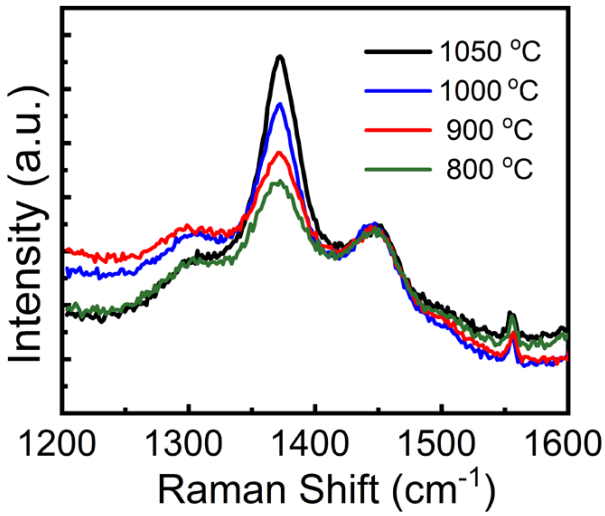

Fig. S7 Raman spectra of multilayer h-BN grown at different temperatures.

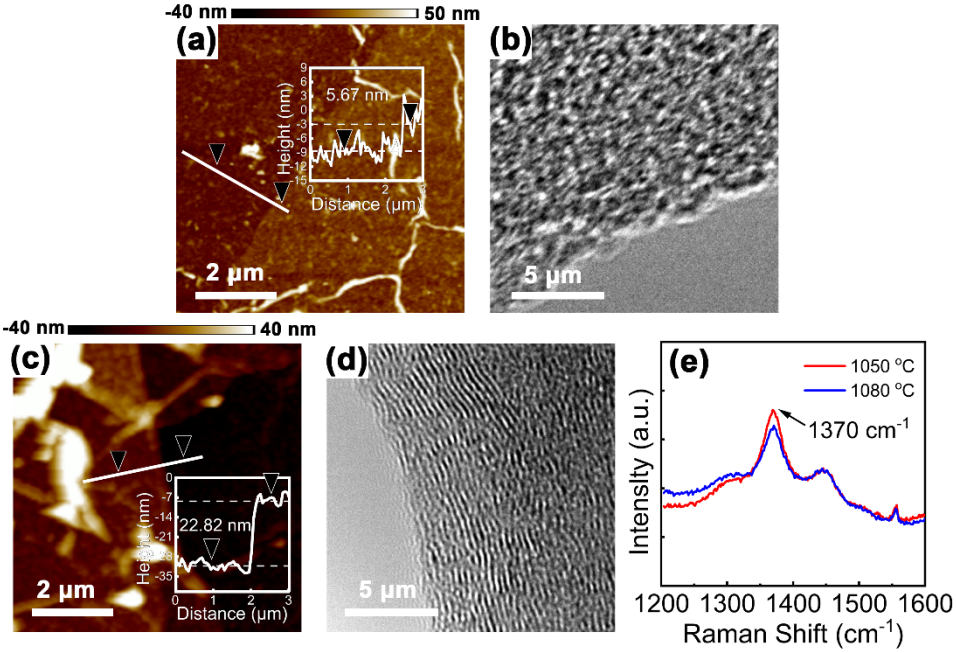

Fig. S8 Characterizations of h-BN thin films grown at (a, b) 700 °C and (c-e) 1080 °C.

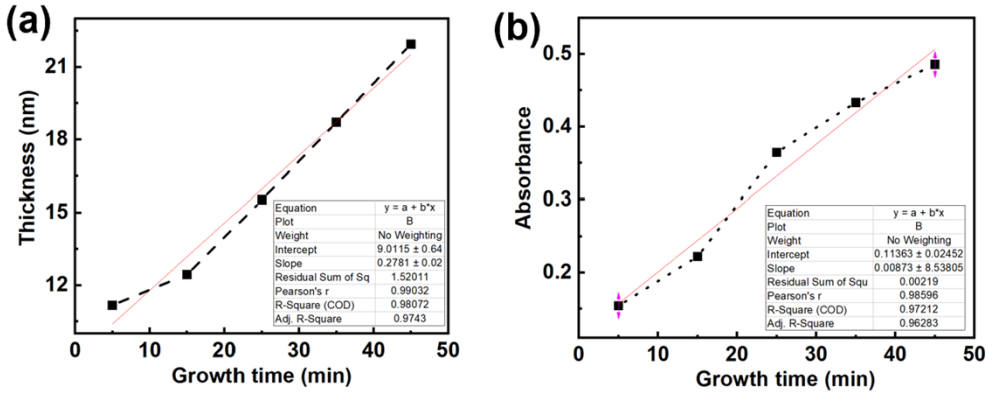

Fig. S9 Linear fit analysis for the thickness vs. growth time curve (a) and the peak absorbance vs. growth time curve (b).

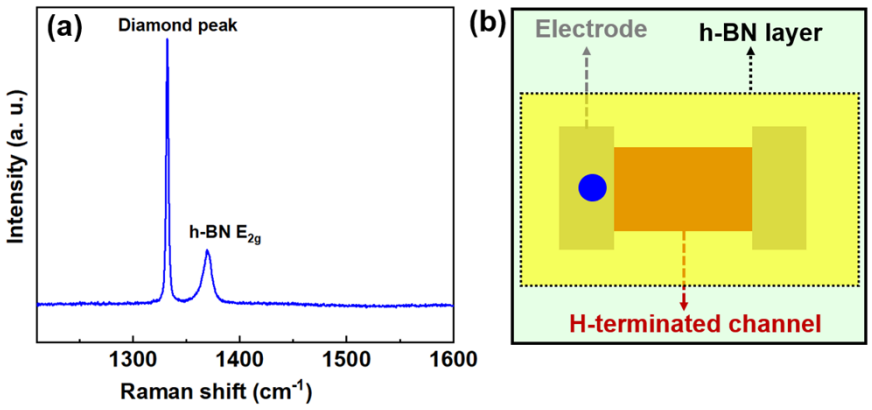

Fig. S10 (a) Raman spectrum of h-BN/H-diamond heterostructure. (b) The schematic shows the tested point in the device.