

Electronic Supplementary Information

Water-Assisted Growth of Large-Sized Single Crystal Hexagonal Boron Nitride Grains

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Table S1 Growth conditions of h-BN with different amount of water vapor

Figure	Growth Temperature (°C)	Belt heating temperature(°C)	Ar (sccm)	H ₂ + water vapor (sccm)	Growth time (min)
2a	1140	70	20	3 + 0	50
2b	1140	70	20	0 + 3	50
2c	1140	70	20	0 + 10	50
2d	1140	70	20	0 + 20	50

Table S2 Etching conditions of h-BN domains with different Ar, H₂ and water vapor.

Figure	Etching Temperature (°C)	Ar (sccm)	Ar + water vapor (sccm)	H ₂ (sccm)	H ₂ + water vapor (sccm)
S3a	1000	20	20	0	0
S3b	1000	20	20	0	0
S3c	1000	0	0	3	3
S3d	1000	0	0	3	3

Table S3 Shape evolution of h-BN domains with different Ar:H₂ flow ratio.

Figure	Growth Temperature (°C)	Belt heating temperature(°C)	Ar (sccm)	H ₂ + water vapor (sccm)	Growth time (min)
3a and 3e	1140	70	20	3	60
3b and 3f	1140	70	100	3	60
3c and 3g	1140	70	200	3	60
3d and 3h	1140	70	400	3	60

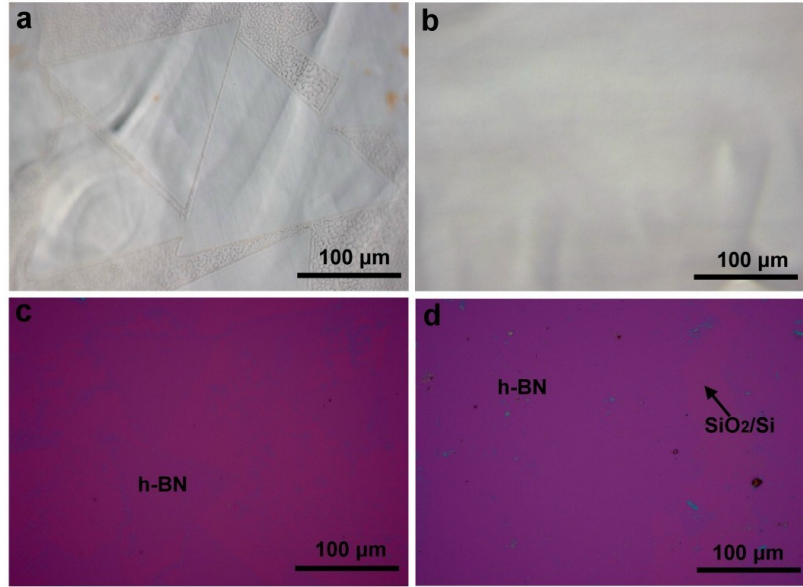


Fig. S1 (a) Optical image of triangular h-BN domains on Cu foil. (b) Optical image of h-BN film on Cu foil. (c) and (d) Optical images of h-BN transferred onto SiO₂/Si substrate.

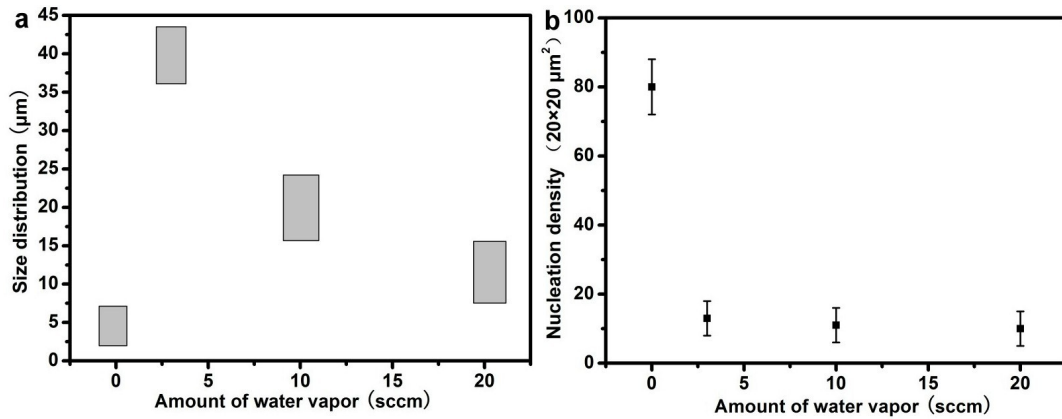


Fig. S2 (a) Size distribution of h-BN domains as a function of the amount of water vapor. (b) Nucleation density of h-BN in a $20 \times 20 \mu\text{m}^2$ area as a function of the amount of water vapor. These data are obtained based on the experimental conditions of Fig. 2.

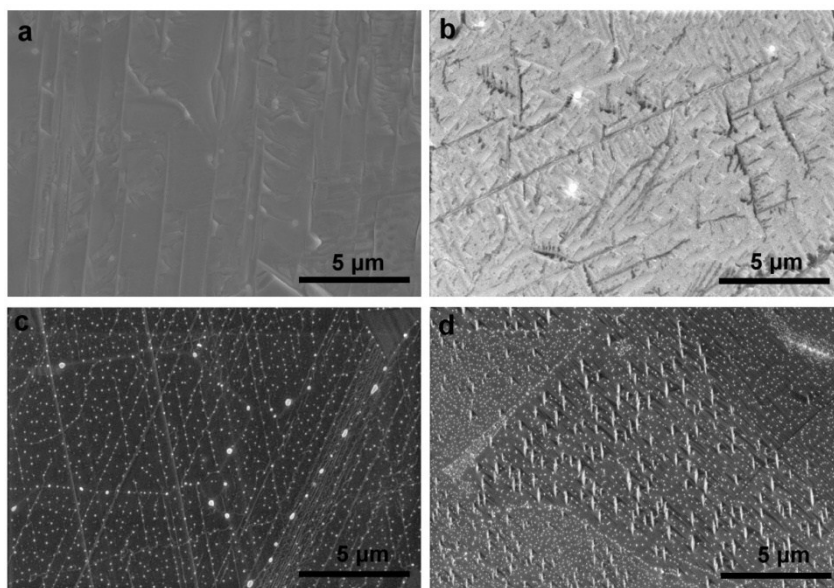


Fig. S3 Typical SEM images of a series of etched h-BN patterns under different etching conditions. (a) Ar gas. (b) Ar gas and water vapor. (c) H₂ gas. (d) H₂ gas and water vapor.

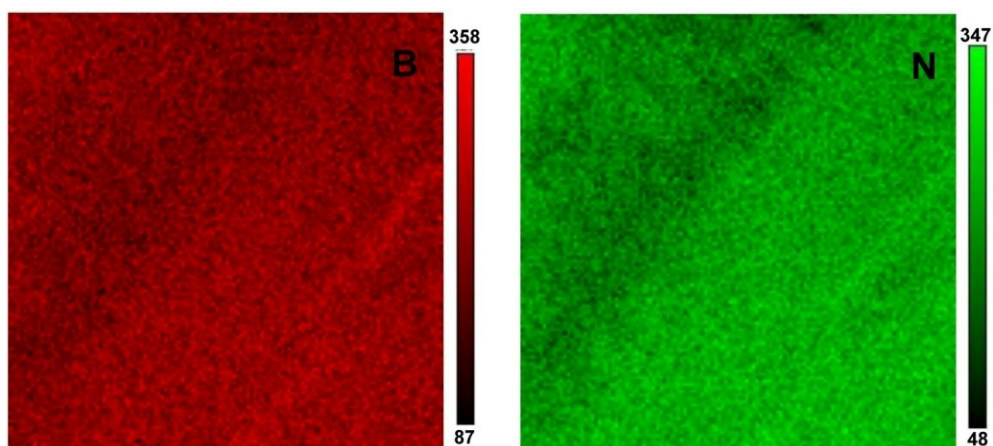


Fig. S4 The corresponding B (KLL) and N (KLL) Auger electron maps for h-BN film, respectively.

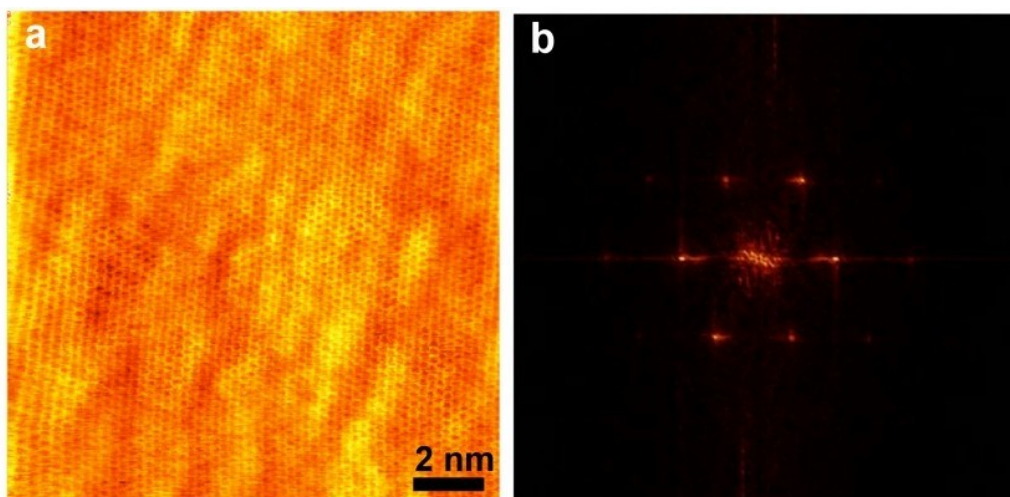


Fig. S5 A STM current image (a) and the corresponding Fourier transform image (b) of monolayer h-BN on Cu surface, showing the typical h-BN lattice structure with lattice constant of 0.253 nm.

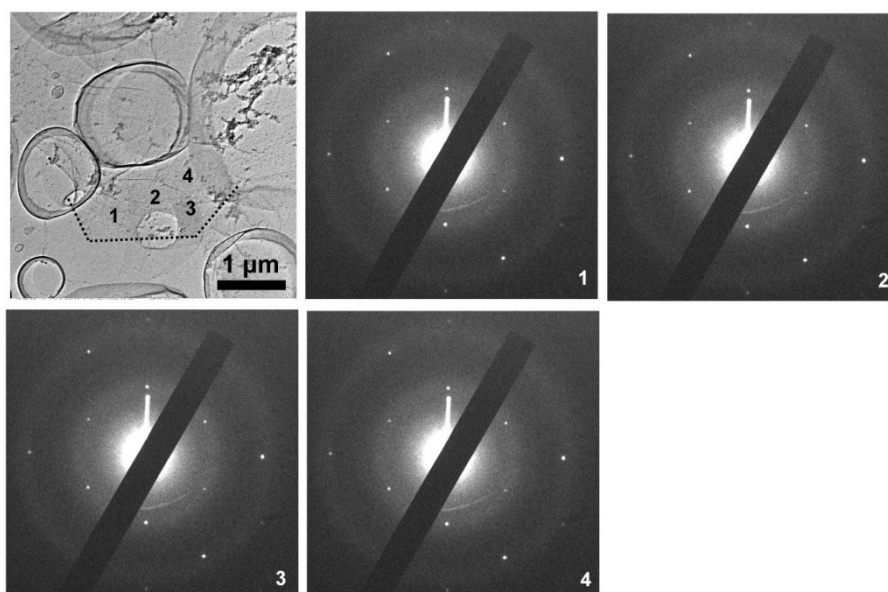


Fig. S6 A typical TEM image of a hexagonal h-BN on holey carbon grid and SAED patterns recorded on different locations labeled in TEM image.

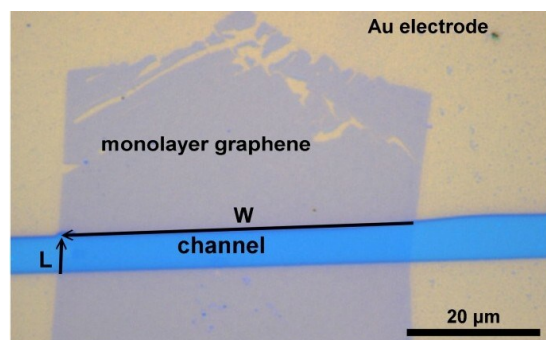


Fig. S7 (a) A typical optical image of a graphene/h-BN/SiO₂/Si FET device showing hexagonal graphene flake and Au electrodes. Channel length and width are also indicated in the image