Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Materials for

Unravelling the Electromechanical Coupling in Graphene/*h*-BN Heterostructure

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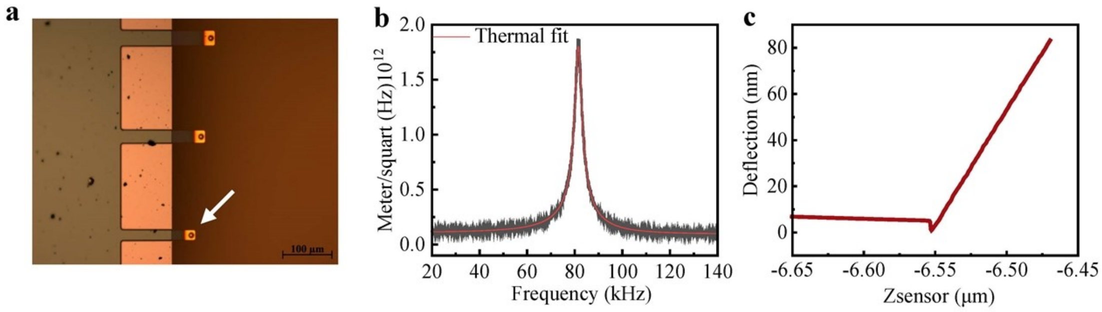
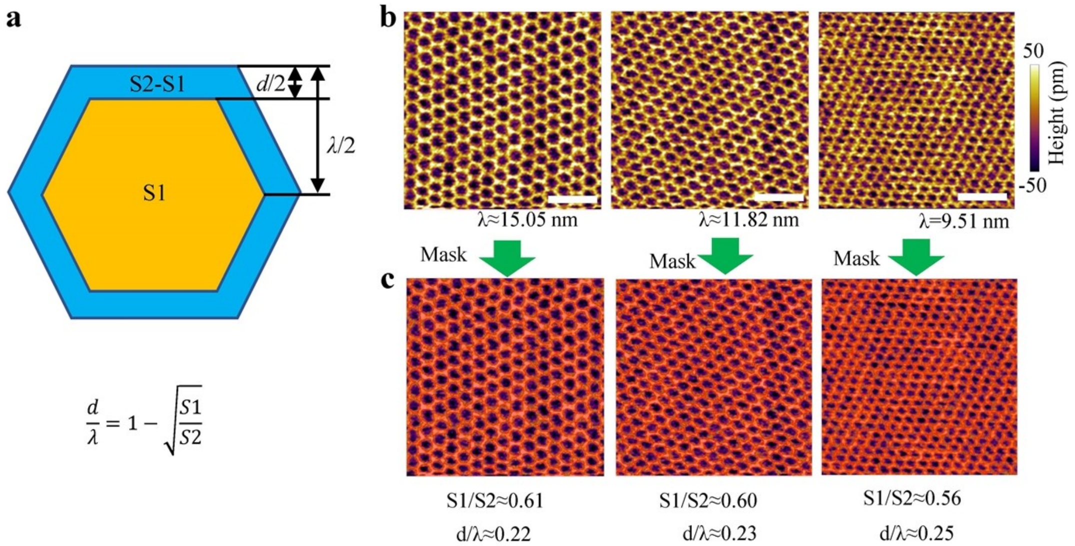
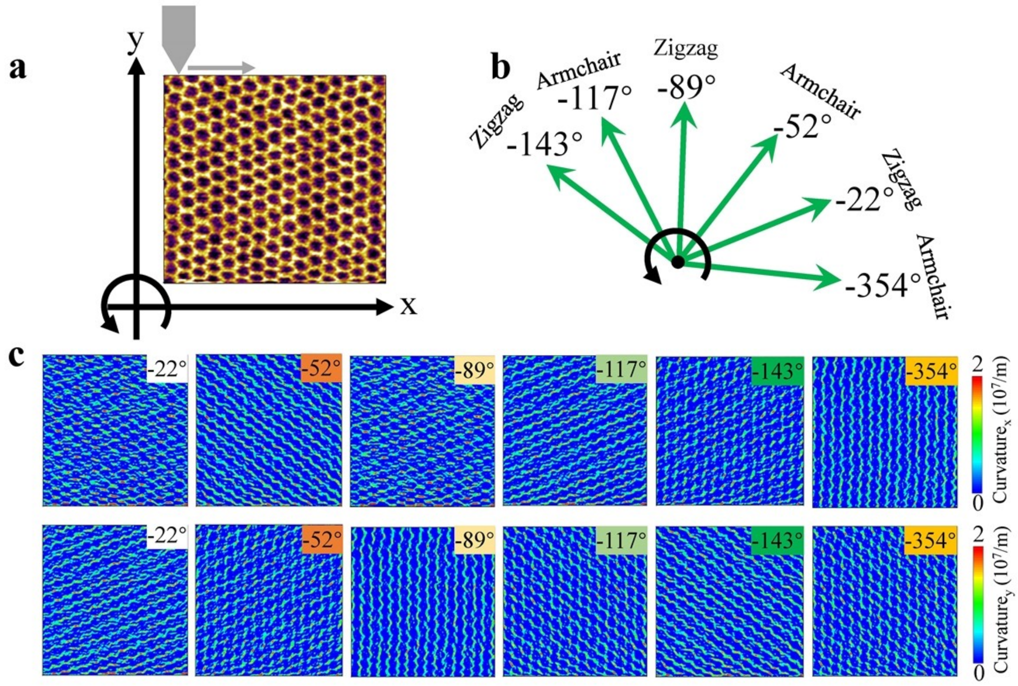


Supplementary Fig. 1. The calibration and accurate quantification of tip force. a. The probe (the shortest one) used to detect the height fluctuation of the moiré pattern by the lateral force mode. **b** Thermal curves of cantilever for calculating the lever sensitivity. **c** The deflection-Zsensor curves for calculating the spring constant.

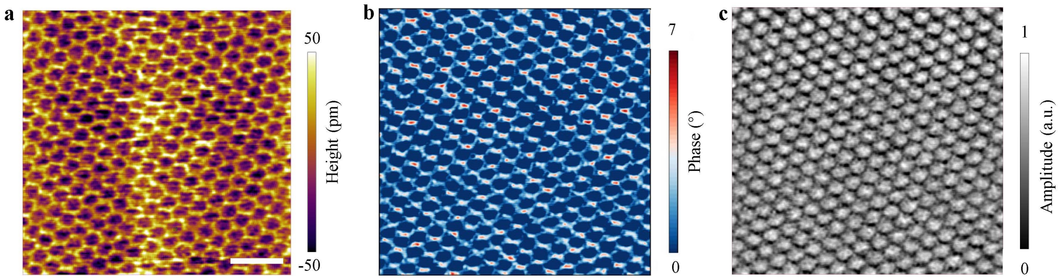
The precise tip force was calculated by multiplying the spring constant, the inverse optical lever sensitivity (InvOLS), and setpoint. The spring constant and InvOLS are estimated to be ~291.12 pN/nm and ~83.36 nm/V by fitting the deflection-Zsenor and the thermal curves. The precise tip force can be calculated by multiplying the spring constant, InvOLS and setpoint. In our work, the topographic corrugation and PFM measurements were conducted using a small contact force of ~8 nN. The frictional results were conducted using a relatively larger contact force of ~24 nN.



Supplementary Fig. 2. The estimated *d/λ* in the total topographic mapping with a varied period. a The value of *d/λ* estimated according to the relationship between *d/λ* and the area ratio of the domain and domain wall in the moiré pattern. **b** The topographic corrugation in moiré pattern with different period. **c** The entire area ratio of domain and domain walls in the topography mapping can be estimated by the AFM mask tools. The scale bar is 50 nm

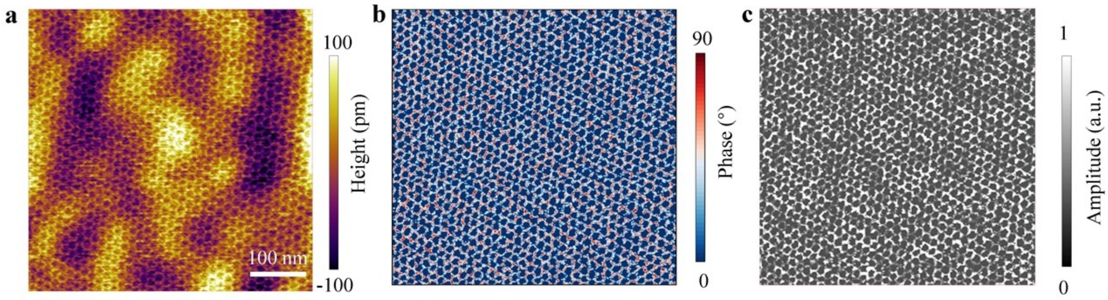


Supplementary Fig. 3. The calculated strain gradient (curvature) by rotating *x*-*y* axes to align *x* axes with the zigzag and armchair orientation. a The topographic corrugation in moiré pattern with high-resolution imaging by using a small contact force (~8 nN). **b** The schematics of different rotation angle of *x*-*y* axes to align *x* axes with the zigzag and armchair orientation. **c** The calculated strain gradient in *x* and *y* axes direction by rotating *x* axes to align *x* axes with the zigzag and armchair orientation.

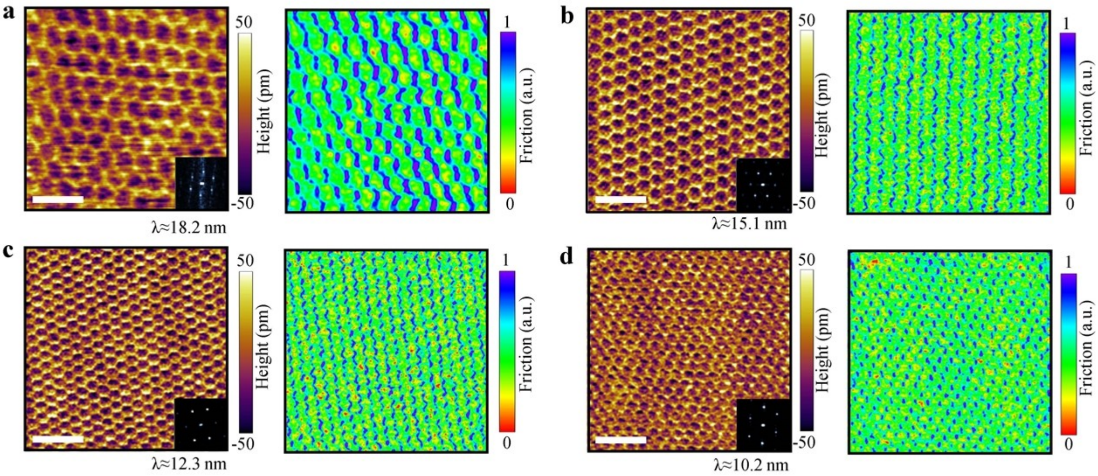


Supplementary Fig. 4. The raw PFM result without deducting PFM noise vector.

a-c The topographic corrugation, PFM phase and PFM amplitude map in moiré pattern, respectively. The scale bar is 50 nm



Supplementary Fig. 5. The PFM characterization of moiré pattern on the underlying substrate with uneven morphology. a-c The topographic corrugation, PFM phase and PFM amplitude measured in moiré pattern, respectively.



Supplementary Fig. 6. The topographic corrugation and frictional result of moiré pattern with a varied period. a-d The measured result of moiré pattern with a period of ~18.2 nm, 15.1 nm, 12.3 nm and 10.2 nm at a relatively large contact force (~24 nN), respectively. The scale bar is 50 nm.