

Supporting information for:

**Dynamic observation of layer-by-layer growth and removal of
graphene on Ru(0001)**

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Video. An in-situ LEEM video acquired from the C/Ru(0001) surface during a heating and cooling cycle in UHV (field of view = 10 μm ; start voltage = 16.1 V). The sample temperatures displayed in the video were measured by a W-Re thermocouple welded at the sample stage. The sample temperature was first ramped from 900 to 1015 $^{\circ}\text{C}$, and subsequently decreased from 1015 to 850 $^{\circ}\text{C}$. The ramping and cooling rate used was 0.5 $^{\circ}\text{C}/\text{s}$. The LEEM video was recorded during this heating and cooling cycle with one image per second. The video can also be downloaded from the website <http://fruit.dicp.ac.cn/images/LEEM1.gif>.

Figure S1. Still image from the video.

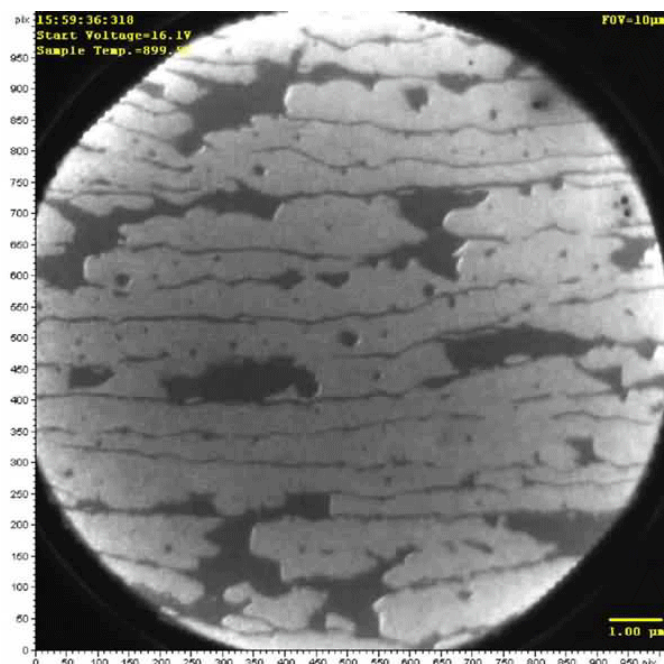


Figure S2. STM images of multilayer graphene on Ru(0001). (A): 500 nm × 500 nm, $V_s = -1.0$ V; (B): 400 nm × 400 nm, $V_s = -0.5$ V. Bilayer graphene was observed in the middle of the image and the left part was covered by monolayer graphene. The bilayer graphene shows less ordered structure in the STM images.

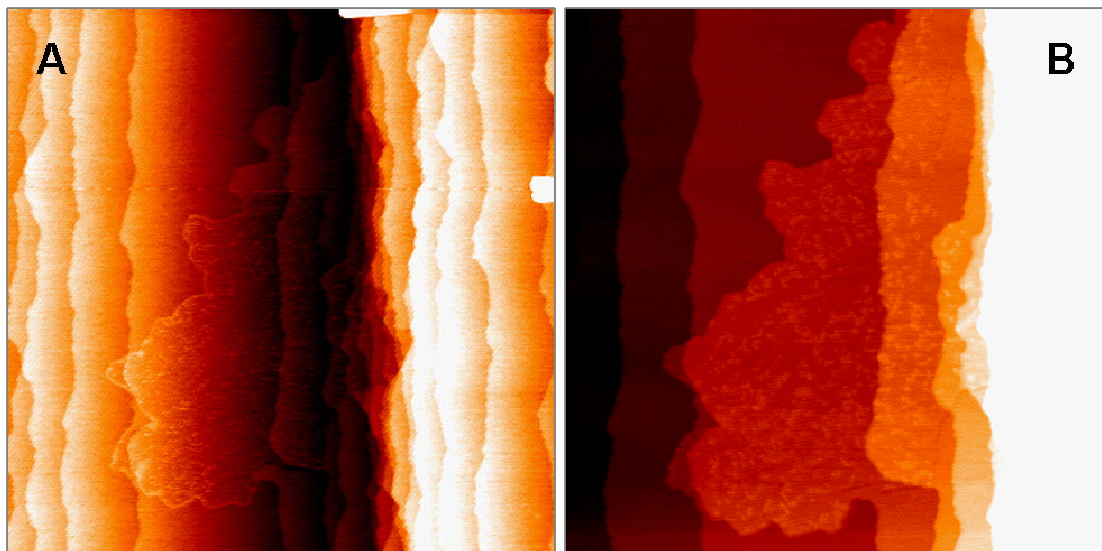


Figure S3. A STM image containing bare Ru(0001) and monolayer graphene regions. In comparison to the bare Ru(0001) region, the graphene covered Ru(0001) region shows the typical moire patterns with 3 nm periodicity. The height profile along the line marked in the STM image was also given. The height of an atomic step of Ru(0001) is measured at 0.22 nm. The height of monolayer graphene is between 0.17 and 0.24 nm.

