

Supporting information for:

Formation of Identical-size Graphene Nanoclusters on Ru(0001)

Yi Cui, Qiang Fu*, Hui Zhang, Xinhe Bao*

*State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, the Chinese Academy of Sciences,
Dalian 116023, P.R. China*

Experimental:

Our experiments were conducted in a customized Omicron multi-chamber system, where scanning tunnelling microscopy (STM) and high resolution electron energy loss spectroscopy (HREELS) can be performed in different chambers without breaking the UHV environment. The clean Ru(0001) and Pt(111) surface were prepared by cycles of Ar⁺ sputtering (1.5 keV) and UHV annealing up to 1600 K and 1100 K, respectively. The sample temperatures lower than 1100 K were measured by a chromel-alumel thermocouple, while temperatures higher than 1100 K were monitored by an infrared thermometer (Land Cyclops 100). Various gases, such as O₂ and C₂H₄, can be introduced into each chamber by directly backfilling the chambers through leak valves. Coronene molecule (Aldrich, purified by sublimation, 99%) was outgassed by heating to 380 K for 2 h in UHV. During the deposition, the temperature of the Knudsen cell was kept at 370 K and the background vacuum was better than 5×10^{-10} mbar. The STM measurements were carried out at room temperature (RT) using a home-made W tip. HREELS was operated with the primary beam energy at 4 eV, and the angles of incidence and reflection beams are 60 degree with respect to the surface normal in the specular direction.

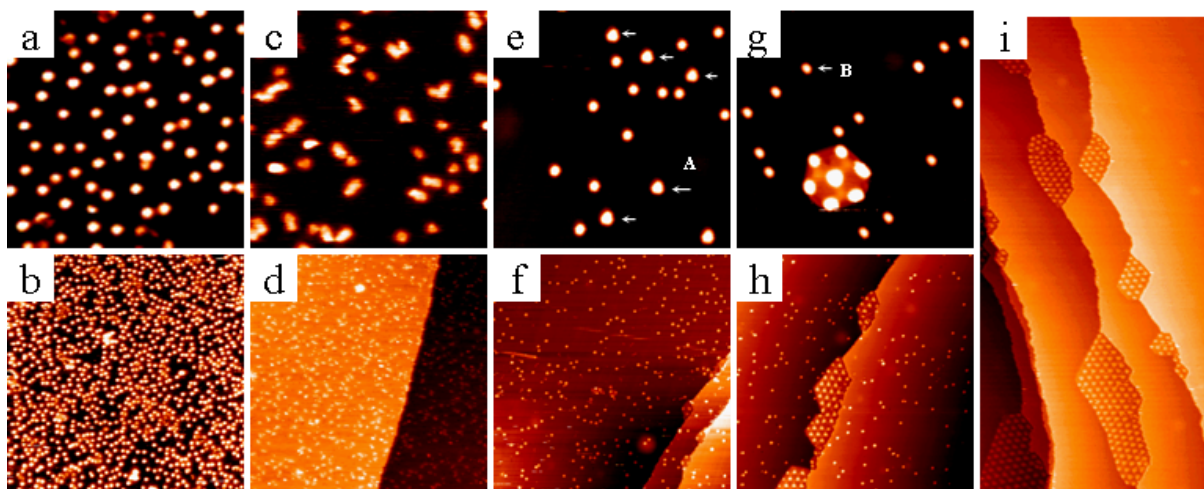


Figure S1. STM images (a, c, e, g: 25 nm $\times$ 25 nm; b, d, f, h: 100 nm $\times$ 100 nm; i: 100 nm $\times$ 200 nm) of the graphene growth on Ru(0001) using coronene as the precursor. Coronene was deposited onto the Ru(0001) surface at 500 K (a and b), followed by stepwise annealing at 550 K (c and d), 900 K (e and f), 1000 K (g and h) and 1100 K (i) for 3 minutes, respectively.

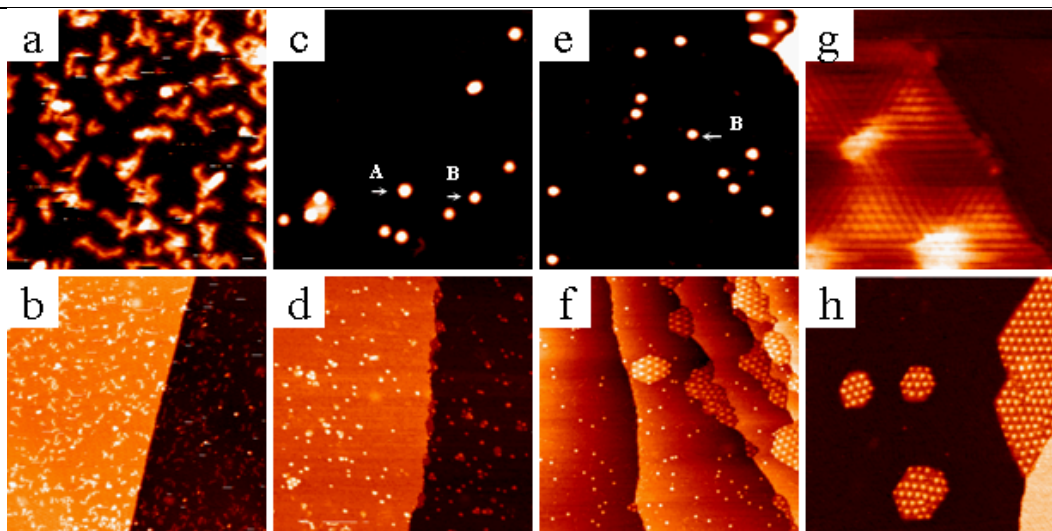


Figure S2. STM images (a, c, e: $25\text{ nm} \times 25\text{ nm}$; g: $6\text{ nm} \times 6\text{ nm}$; b, d, f, h: $100\text{ nm} \times 100\text{ nm}$) of the graphene growth on Ru(0001) using ethylene as the precursor. Ethylene was dosed onto the Ru(0001) surface at RT (a and b), followed by stepwise annealing at 900 K (c and d), 1000 K (e and f) and 1100 K (g and h) for 3 minutes, respectively.

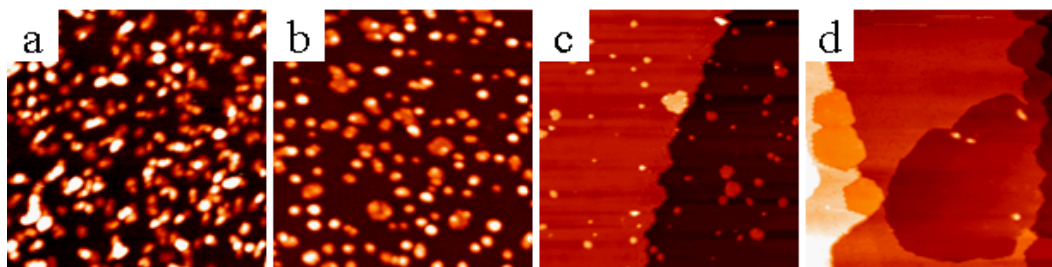


Figure S3. STM images (a and b, $40\text{ nm} \times 40\text{ nm}$; c, $100\text{ nm} \times 100\text{ nm}$; d, $80\text{ nm} \times 80\text{ nm}$) of the graphene growth on Pt(111) using ethylene as the precursor. 3 L ethylene was dosed onto the Pt(111) surface at RT, followed by stepwise annealing at 600 K (a), 900 K (b), 1000 K (c) and 1100 K (d) for 3 minutes, respectively.

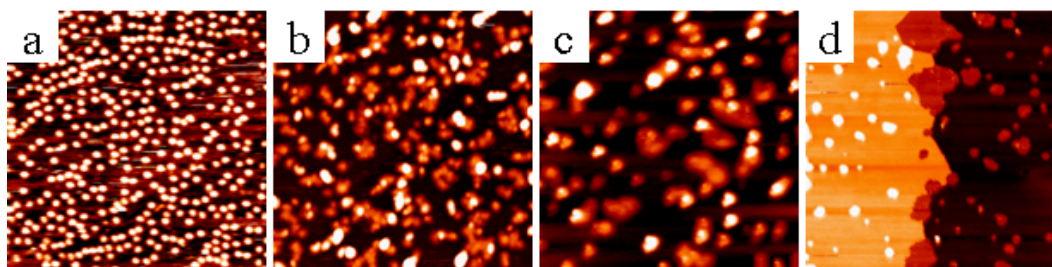


Figure S4. STM images (a, b and c: $40\text{ nm} \times 40\text{ nm}$; d: $100\text{ nm} \times 100\text{ nm}$) of the graphene growth on Pt(111) using coronene as the precursor. Coronene was deposited onto the Pt(111) surface at RT (a), followed by stepwise annealing at 600 K (b), 900 K (c), and 1000 K (d) for 3 minutes, respectively.