

Supplementary Information

High vacuum synthesis and ambient stability of bottom-up graphene nanoribbons

Andrew Fairbrother, Juan-Ramon Sanchez-Valencia, Beat Lauber, Ivan Shorubalko, Pascal Ruffieux, Tobias Hintermann, Roman Fasel*

This Supporting Information contains scanning tunneling microscopy (STM) images obtained during high vacuum synthesis of 7 carbon atom-wide armchair graphene nanoribbons (7-AGNRs) (Fig. S1) and substrate poisoning (Fig. S2). The images in Fig. S1 were used to determine the type of coupling during the polymerization step of GNR synthesis, including ribbon-like, transition, and dendritic coupling. Fig. S2 shows images obtained after GNR synthesis on a substrate under different water and oxygen poisoning conditions. Fig. S3 shows STM of GNRs stored in air for seven days. Intact GNRs are clearly visible, along with evidence of some adsorbates (surface contamination). Fig. S4 shows Raman spectra of GNRs before and after transfer to Al_2O_3 and CaF_2 . Fig. S5 shows more electrical characteristics of the 7-AGNR-FET presented in Fig. 3.

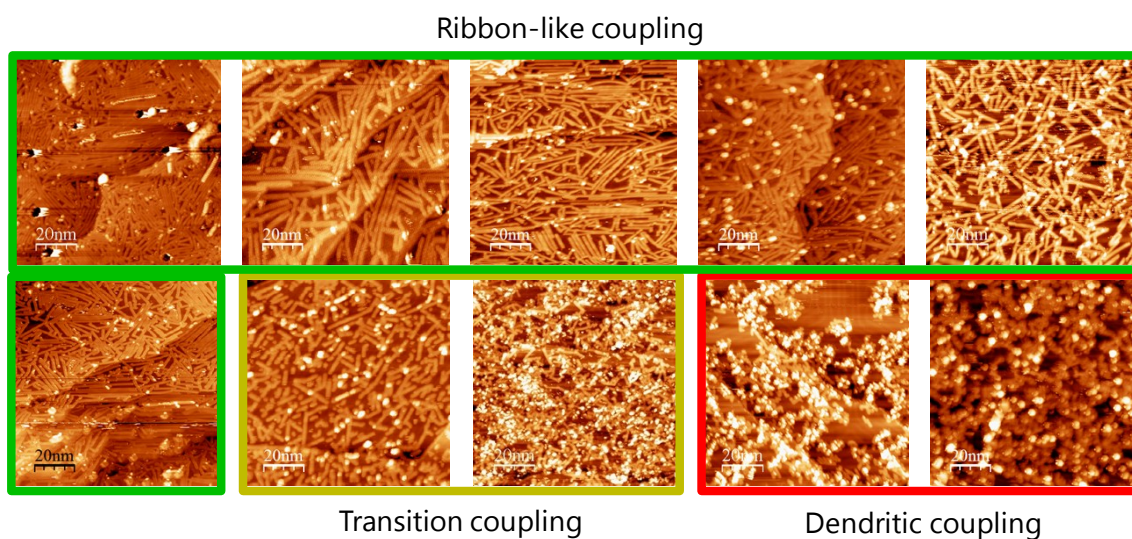


Fig. S1. STM images from the data points presented in Fig. 1 of the main text, images are in the same order of the data points, from left to right. All scale bars are 20 nm.

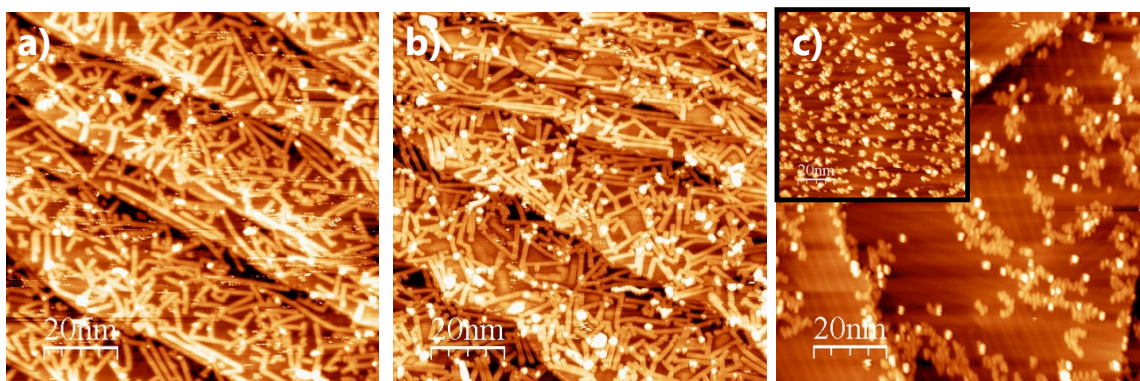


Fig. S2. STM images showing 7-AGNRs grown on Au(111) poisoned with water and oxygen ($p_{\text{H}_2\text{O}} \cdot p_{\text{O}_2} = 10^{-12}$ mbar²) prior to DBBA deposition. Dosing time was 45 minutes, and the substrate temperature was room temperature (a) or 200 °C (b). No additional substrate preparations were made prior to growth, though the pressure was allowed to recover to 10^{-8} mbar (~30 minutes). In (c) the Au(111) surface was cleaned and then removed from UHV into air, and then reintroduced with no additional substrate cleaning prior to growth, resulting in entirely dendritic growth. Inset shows STM (at 40 K) of the surface after exposure to atmosphere and before DBBA deposition. All scale bars are 20 nm.

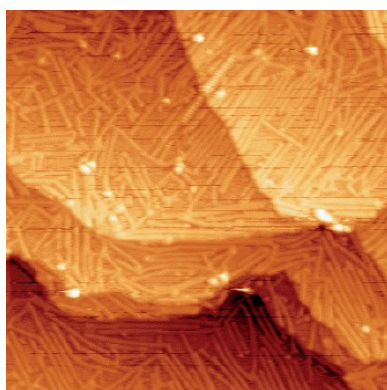


Fig. S3. STM of GNRs stored in air for seven days, showing intact GNRs and some adsorbed contaminants from the atmosphere.

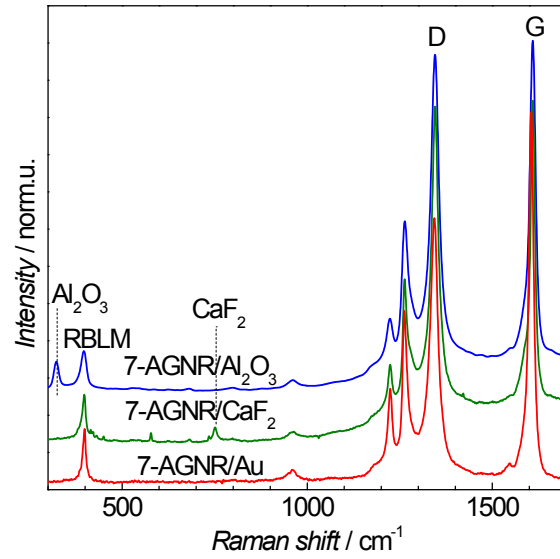


Fig. S4. Raman spectra of 7-AGNRs before and after transfer to Al_2O_3 and CaF_2 , indicating that the ribbons maintain their structural integrity during the transfer process.

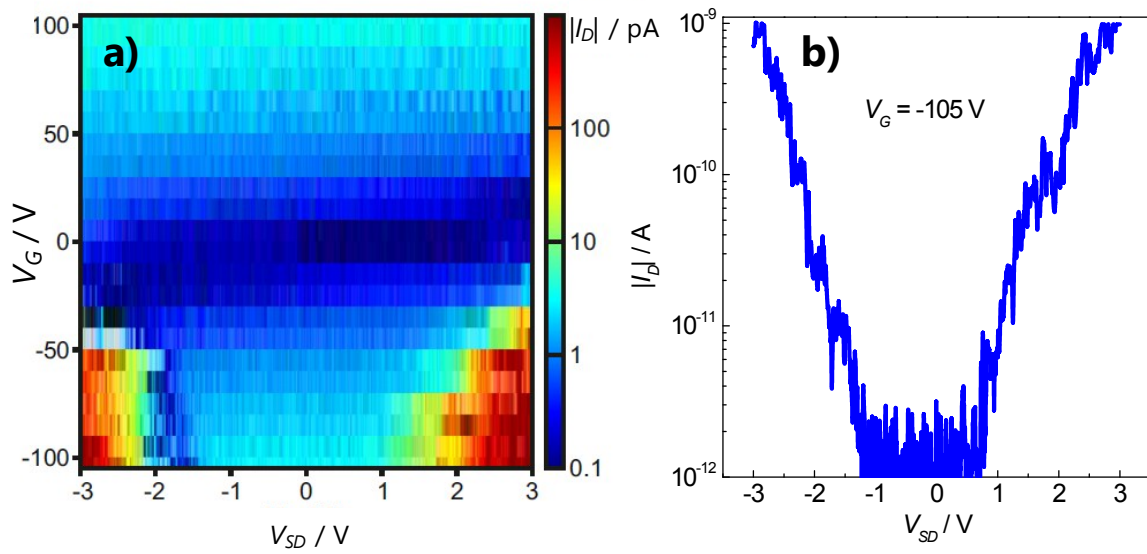


Fig. S5. Additional electrical characteristics of a 7-AGNR-FET, including I_D vs V_G vs V_{SD} (a) and I_D vs V_{SD} (b).