

INTERMEDIATE STATES OF GRAPHENE NANORIBBONS ON CU(111)

B. Alldritt¹, F. Schulz^{1,2}, P. Liljeroth¹

¹Atomic Scale Physics, Department of Applied Physics, Aalto University, P.O. Box 15100, FI-00076 AALTO, Finland

²IBM Zurich Research Laboratory, Zurich, Switzerland

Email: benjamin.alldritt@aalto.fi

The down-scaling of Si CMOS devices has encountered challenges related power and heat dissipation[1] resulting in the need for new material selection. The use of single molecules, such as graphene nanoribbons (GNR), as transistors or device interconnects holds the possibility of significantly improving the performance and power consumption of consumer electronic devices. Recent developments in the synthesis of graphene nanoribbons have allowed for atomically precise construction via on-surface synthesis from molecular precursors[2, 3]. While the precursor toolbox for different GNRs has expanded rapidly, specific reaction pathways and the role of the catalytic metal substrate in the GNR growth have not yet been worked out in detail [4].

In this work, low-temperature evaporation of planar dibromoperylene (DBP) was performed on a Cu(111) surface to determine the reaction pathway from individual DBP monomers to GNR formation. With controlled annealing, it was possible to synthesize intermediate structures step by step. Scanning tunneling microscopy (STM), non-contact atomic force microscopy (nc-AFM), and Kelvin-probe force microscopy (KPFM) experiments performed at low-temperature were used to confirm the evolution of the intermediate states to armchair nanoribbons. We find that the interaction between the Cu(111) surface and the DBP precursor influences the resulting GNR structure. The intermediate structures formed are stabilized by the Cu(111) substrate and further annealing results in armchair GNR formation.

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