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Bottom-up synthesis of N=11 armchair graphene nanoribbons via new sp3 to sp2 cyclization route ZAHRA PEDRAMRAZI, CHEN CHEN, DANNY HABERER, WADE PERKINS, FELIX FICSHER, MICHAEL CROMMIE, UC Berkeley, CROMMIE GROUP TEAM, FISCHER GROUP TEAM — Bottom-up synthesis is a powerful fabrication tool for controlling the atomic scale structures of graphene nanoribbons (GNRs). The electronic properties of GNRs, 1D strips of graphene that exhibit energy gaps in their electronic structure due to quantum confinement, is highly dependent on precise width and atomic edge structure. The molecular precursors used to date for bottom-up synthesis are based on conjugated systems of sp2-bonded carbon atoms. Here we demonstrate a new molecular precursor for synthesis of bottom-up N=11 armchair GNRs that exhibits cyclodehydrogenation of "out-of-plane" sp3-bonded elements. Scanning tunneling microscopy imaging was used to characterize the GNR growth reaction at different annealing temperatures, allowing observation of the sp3 to sp2 cyclization process. This demonstrates a new chemical route for achieving armchair GNRs, as well as new insight into surface-based covalent self-assembly of organic molecules.

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