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Local electronic structure of atomically-precise graphene nanoribbon heterojunctions HSIN-ZON TSAI, GIANG D. NGUYEN, ARASH A. OMRANI, TOMAS MARANGONI, MENG WU, DANIEL J. RIZZO, GRIFFIN F. RODGERS, RYAN R. CLOKE, REBECCA A. DURR, UC Berkeley, YUKI SAKAI, UT Austin, FRANKLIN LIOU, ANDREW S. AIKAWA, UC Berkeley, JAMES R. CHELIKOWSKY, UT Austin, STEVEN G. LOUIE, FELIX R. FISCHER, MICHAEL F. CROMMIE, UC Berkeley/LBNL/Kavli ENSI — Graphene nanoribbons (GNRs) are one-dimensional strips of graphene that exhibit novel electronic and magnetic properties. Bottom-up synthesis of GNRs via self-assembly of molecular precursors yields nanoribbons with atomic-scale structural control, thus allowing precise tuning of properties such as bandgap, edge chirality, and heteroatom doping. Here we report the local electronic structure characterization of bottom-up GNR heterojunctions fabricated from a only single type of molecular precursor. Using this new molecule, bottom-up GNRs were grown that incorporate sacrificial carbonyl groups along their edges. Subsequent thermal annealing of the GNRs after growth was used to induce removal of the carbonyl groups through a bond cleavage process. STM spectroscopy shows that these segments have different electronic properties, thus allowing formation of Type II heterojunctions with atomically well-defined interfaces. Experimental bandedge energy level alignment and wave function distributions are consistent with first principles theoretical simulations for this bottom-up heterojunction system.

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