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Bandgap Engineering of Bottom-up Synthesized graphene nanoribbon junctions ZAHRA PEDRAMRAZI, YEN-CHIA CHEN, CHEN CHEN, DANNY HABERER, TING CAO, Univ of California - Berkeley, DIMAS OTEYZA, Materials Physics Center, San Sebastian, Spain, FELIX FISCHER, STEVEN LOUIE, MICHAEL CROMMIE, Univ of California - Berkeley — Bandgap engineering is a key concept in electronic device fabrication, through which various types of semiconductor heterostructures have been realized. However, as the size of electronic building blocks is approaching the physical limits of well-established top-down methods, the need for alternative strategies towards electronic devices becomes apparent. Considering the recent progress in bottom-up synthesis of graphene nanoribbons (GNRs), components with single-atom thickness and sub-2 nm width may be realized based on GNRs. The electronic properties of GNRs are crucially depending on their width and edge geometry, and it has been predicted that intra-ribbon bandgap engineering may be achieved by varying width or doping at desired positions. Here, we demonstrate the successful realization of bottom-up narrow-wide GNR junctions, consisting of covalent bonding of armchair segments having either 7 or 13 carbon dimer lines across the width (i.e. the n=7 and n=13 segments are "welded together" at the atomic scale). We study the resultant 7-13 junctions with scanning tunneling microscopy (STM) and spectroscopy (STS), and identify distinct electronic structures in different GNR segments. We have further performed first-principles calculations to support our experimental results.

Zahra Pedramrazi
Univ of California - Berkeley

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