Graphene nanoribbons as components in electric nano-circuits

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Graphene nanoribbons (GNRs) are considered promising candidates for all-graphene integrated circuits of nanoscale dimensions due to the possibility of controlling a broad range of electronic properties by bottom-up chemical self-assembly. Junctions connecting two or more GNRs are essential components for building such circuits and hence clear understanding of their electrical characteristics is critical. We have explored numerous GNR nanostructures containing quantum-dots[1], integrated metal-semiconductor-metal junctions[2] as well as defective nanoribbons[3]. Additionally, extensive screening of hundreds of thousands of disctinct configurations with numerical calculations [4] reveal the underlying structure-property relationships with crucial roles played by the bipartite symmetry of graphene, localized resonant states and geometry of the GNR junctions. Overall, our work defines the guidelines for engineering GNR junctions with desired electrical properties.

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