Controlling the Chirality of Graphene's edges using Polarization Selective Laser Annealing

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The electronic and optical properties of graphene strongly depend on the chirality of its edges[1]. While zigzag edges are metallic, armchair-terminated edges are semiconducting and are thus desired for numerous photonic and electronic applications. However, conventional fabrication procedures favor the formation of the zigzag edge. Here we show that impure armchair edges may be purified post-fabrication by using polarization-selective laser annealing[2]. This technique was used to purify the edges of 30 nm wide graphene nanoribbon transistors. Transport measurements of optically annealed graphene nanoribbons (GNRs) reveal a 50% increase of the GNR energy gap after annealing, consistent with an increased percentage of armchair segments. Furthermore, μ-Raman spectroscopy reveals a greater armchair edge purity post annealing. These results suggest that edge chirality of graphene devices can be optically purified post fabrication, thereby enabling the realization of chiral graphene nanoribbons and heterostructures.

References:

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