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Small, Medium, Large -

from Nanographenes to Graphene Nanoribbons and Graphene

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This is a chemistry-driven journey through the graphene landscape with size and dimensionality as guidelines. The key breakthrough comes from graphene nanoribbons (GNRs), quasi-1D-semiconductors which emerge as unique carbon nanostructures and versatile electronic materials. Their band structures can be widely tuned yielding semiconductors and even topological insulators. The most important features are i) the opening of a band gap due to the geometric confinement, ii) the detection of amplified spontaneous emission and iii) the occurrence of edge localized electronic states with spin polarization. All characteristics offer new technological opportunities, for example, adding the spin degree of freedom to graphene-based circuitry.

Conceptually, GNRs have two important functions: they close the gap between conjugated polymers and graphene and they utilize small nanographene molecules such as the “rhombenes” to create new electronic structures.

In the driver’s seat is precision polymer synthesis which becomes possible by i) repetitive cycloaddition in solution, ii) on-surface polymerization after immobilization of monomer building blocks and iii) chemical vapor deposition.

References

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