Graphene and Graphene Nanoribbons

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This is a chemistry-driven journey through the graphene landscape with structural precision as key requirement. The major breakthrough comes from graphene nanoribbons (GNRs), quasi-1D-semiconductors, which emerge as unique carbon nanostructures and versatile materials for electronics, optics and energy technology. 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, a major difference from graphene, and ii) the occurrence of edge localized electronic states with spin polarization.

In the driver's seat for, both, graphene and graphene nanoribbon fabrication are chemical techniques such as i) polymerization by repetitive cycloaddition in solution, ii) on-surface polymerization after immobilization of monomer building blocks, iii) chemical vapor deposition including etching of copper substrates, iv) controlled pyrolysis and v) electrochemically assisted exfoliation from graphite.

All characteristics offer new technological opportunities, for example, adding the spin degree of freedom to graphene-based circuitry or pushing the power density for energy storage in supercapacitors. Comparing materials performances of graphene and graphene nanoribbons is most revealing.

References

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