A Diels–Alder Approach to Graphene Nanoribbon Precursors

Significance: Bottom-up approaches to graphene nanoribbons (GNRs) have been limited by the short length of nanoribbons produced (<50 nm) or the requirement for metal surfaces. The authors report a bottom-up approach to the synthesis of longer (>100 nm), structurally defined GNRs using an AB-type Diels–Alder polymerization to form nanoribbon precursors that can be planarized to GNRs by oxidative cyclodehydrogenation with FeCl₃.

Comment: Despite the formation of multiple regioisomers after the Diels–Alder polymerization of asymmetrical monomer 7, upon planarization, all isomers of 8 yielded an identical GNR structure (9). Polymerization of 7 was carried out both in solution and melt, with melt yielding GNR precursors of significantly higher Mₘ (230,000–550,000 g/mol versus 42,000–78,000 g/mol for solution polymerization).