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Single-Step Seeded-Growth of Graphene Nanoribbons (GNRs) via Plasma-Enhanced Chemical Vapor Deposition (PECVD)[1] C.-C. HSU, K. YANG, W.-S. TSENG, Dept. of Physics, Caltech, Pasadena, CA, USA, YILIANG LI, Dept. of Mechanical Engineering, Tsinghua University, Beijing, China, YILUN LI, J. M. TOUR, Dept. of Chemistry, Rice University, Houston, TX, USA, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA, USA — One of the main challenges in the fabrication of GNRs is achieving large-scale low-cost production with high quality. Current techniques, including lithography and unzipped carbon nanotubes, are not suitable for mass production. We have recently developed a single-step PECVD growth process of high-quality graphene sheets without any active heating. By adding some substituted aromatic as seeding molecules, we are able to rapidly grow GNRs vertically on various transition-metal substrates. The morphology and electrical properties of the GNRs are dependent on the growth parameters such as the growth time, gas flow and species of the seeding molecules. On the other hand, all GNRs exhibit strong infrared and optical absorption. From studies of the Raman spectra, scanning electron microscopic images, and x-ray/ultraviolet photoelectron spectra of these GNRs as functions of the growth parameters, we propose a model for the growth mechanism. Our findings suggest that our approach opens up a pathway to large-scale, inexpensive production of GNRs for applications to supercapacitors and solar cells.

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