NANO HIGHLIGHT
Electronic Devices from Nano-patterned Epitaxial Graphite

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The electronic properties of graphitic materials are so impressive that they compare favorably with silicon. For instance, coherent and dissipationless electronic transport have been reported in carbon nanotubes, which, depending on geometry, can be either semiconductors or metals. However carbon nanotubes are difficult to pattern. In contrast, epitaxial multilayered graphene (i.e. ultrathin graphite) can be patterned and interconnected using standard lithography methods and is expected to have properties similar to nanotubes. The ultimate structures that are envisioned include all-graphite interconnected devices that rely on coherent electronic transport. Current efforts are focused on producing high quality epitaxial graphite and to demonstrate simple interconnected gated devices (i.e. field effect transistors). Our preliminary low temperature investigations reveal quantum confinement, electronic coherence lengths exceeding a micron, small effective masses ($m^* < 0.02\ m_e$), high mobilities ($\mu > 10^4 cm^2/Vs$) and large current carrying capabilities. Furthermore, a remarkable low temperature electronic phase transition has been identified. These properties suggest that nanopatterned epitaxial graphene (NPEG) is a viable candidate for nanoelectronics and it may further serve as a platform for molecular electronics. This work is in part sponsored by Intel Research.

[1] **Ultrathin Epitaxial Graphite: 2D Electron Gas Properties and a Route toward Graphene-based Nanoelectronics** Berger, C.; Song, Z.; Li, T.; Li, X.; Ogbazghi, A. Y.; Feng, R.; Dai, Z.; Marchenkov, A. N.; Conrad, E. H.; First, P. N.; de Heer, W. A.; *J. Phys. Chem. B. ;* **2004**; *108*(52); 19912-19916.