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**Free-Standing 2-D Graphene Carbon Nanostructures** BRIAN HOLLOWAY, RONALD QUINLAN, Luna Innovations Incorporated, KUN HOU, College of William and Mary — Carbon nanosheets – a new, free-standing, two-dimensional carbon nanostructure – have been deposited on a metal, semiconductor, and insulating substrates by RF PECVD. Raman, SEM, TEM, SAED, XPS, AES, FTIR, and XRD all indicate that nanosheets are graphite sheets up to 8 $\mu$m in height but $\leq$1 nm in edge thickness. The nanosheets stand off the growth substrate in a manner similar to aligned nanotubes grown by CVD. In contrast to nanotubes, nanosheets do not require catalyst for growth and can be patterned after deposition using standard lithographic techniques. Hydrogen etching promotes the formation of the atomically thin structures while the anisotropic dipole created in the graphene planes by the plasma sheath promotes the vertical orientation. Due to their uniform height and the large number of edge emission sites, nanosheets have proven to be excellent field emitters. Nanosheet samples have produced up to 33 mA of current (32 mm$^2$ sample area); similar nanosheet samples have sustained 1.3 mA of current over 200 hours of testing with no degradation.

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