Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Novel Growth Mechanism of Low-Temperature-Grown Graphene by Plasma-Enhanced Chemical Vapor Deposition (PECVD)[1] CHEN-CHIH HSU, DAVID BOYD, WEI-HISANG LIN, NAI-CHANG YEH, Cal Inst of Tech (Caltech) — We show a one-step method that employs PECVD for rapidly producing superior quality, large-area ($\sim$ 1 cm^2), monolayer graphene on Cu at low temperature (LT). The key to our approach is that deposition of high-quality graphene on Cu can be achieved through balancing carbon deposition by methyl radicals with etching of amorphous carbon by atomic hydrogen, while concurrently preparing the Cu surface for growth by cyano radicals. We find that removal of Cu always accompanies graphene growth, as evidenced by the presence of Cu deposits on the quartz tube and sample holder for each successful growth. We are also able to fabricate monolayer graphene by PECVD growth in 3 minutes. Even if the growth time is increased to 20 minutes, we still observe monolayer instead of multilayer graphene, suggesting that the growth mechanism differs from high-temperature CVD grown graphene. Electrical mobility determined by the field-effect-transistor configuration exhibits consistently high values, up to 60,000 cm^2/V-s on BN at 300K, exceeding the best values reported for thermal-CVD graphene on BN. Our findings suggest a promising pathway to large-scale, superior-quality and one-step inexpensive graphene fabrication for scientific research and technological applications.

[1]Work supported by NSF under the IQIM at Caltech.

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Date submitted: 14 Nov 2013 Electronic form version 1.4