Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Superior properties of plasma-assisted room-temperature-grown graphene from STM studies M.L. TEAGUE, W.-H. LIN, D.A. BOYD, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA 91125, Y.-Y. LO, C.-I. WU, Dept. of Elec. Eng., National Taiwan Univ., Taipei, Taiwan, W.-Y. CHAN, W.-B. SU, C.-S. CHANG, Institute of Physics, Academia Sinica, Nankang, Taipei, Taiwan —
We report scanning tunneling microscopic and spectroscopic (STM/STS) studies of large-area monolayer graphene grown at room temperature (RT) on Cu foils, Cu (100) and Cu (111) single crystals, and compare the properties of these samples with high-temperature (1000 °C) CVD-grown graphene. All RT-grown graphene exhibit highly ordered honeycomb structures over $\sim$ 1 cm^2 areas, smooth surface morphology, much reduced strain ($< 0.1\%$) and additional Moire patterns for samples grown on single crystals. The structural quality and reduced strain obtained from STM studies are consistent with finds from Raman spectra. In contrast, high-temperature CVD-grown graphene revealed strongly distorted atomic structures and large strain, giving rise to giant pseudo-magnetic fields and charging effects as manifested by the conductance peaks at quantized energies and the strongly enhanced local conductance in highly strained regions. These strain-induced effects are believed to be responsible for the reduced electrical mobility in typical CVD-grown graphene. The superior structural and electronic properties demonstrated by our RT-grown graphene are promising for a wide range of applications. This work was supported by NSF through IQIM at Caltech.

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Date submitted: 14 Nov 2012 Electronic form version 1.4