Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Experimentally Controlling the Edge Termination of Graphene Nanoribbons XIAOWEI ZHANG, OLEG YAZYEV, University of California, Berkeley and Lawrence Berkeley National Laboratory, JUANJUAN FENG, University of California, Berkeley and Lanzhou University, Lanzhou, China, CHENGGANG TAO, YEN-CHIA CHEN, University of California, Berkeley and Lawrence Berkeley National Laboratory, LIMING XIE, Stanford University, Stanford, STEVEN LOUIE, ALEX ZETTL, University of California, Berkeley and Lawrence Berkeley National Laboratory, HONGJIE DAI, Stanford University, Stanford, MICHAEL CROMMIE, University of California, Berkeley and Lawrence Berkeley National Laboratory — The edges of graphene exhibit several unique features, such as the presence of localized edge states, and are anticipated to be a powerful means of controlling the electronic properties of this two-dimensional material. Understanding such properties, however, requires a precise knowledge of the atomic-scale structure and chemical composition of the edge. In this work, the edges of graphene nanoribbons (GNRs) are controlled by hydrogen plasma and are investigated through a combination of high-resolution scanning tunneling microscopy (STM) and first-principles calculations. We recover the atomic structure of the edge termination in atom-by-atom fashion and establish the chemical nature of terminating functional groups at graphene edge segments of different orientation – (i.e., zigzag, armchair and chiral). These results allow us to conclude that the edges of hydrogen-plasma-etched GNRs are generally free of structural reconstructions and are terminated by hydrogen atoms with no rehybridization of the outermost carbon edge atoms. Both zigzag and chiral edges show the presence of edge states.

Xiaowei Zhang
University of California, Berkeley and
Lawrence Berkeley National Laboratory

Date submitted: 27 Nov 2011 Electronic form version 1.4