Subject: MATERIALS SCIENCE COLLOQUIUM, Prof. Huili (Grace) Xing, University of Notre Dame, Current-carrying capacity of graphene transistors, Thursday, April 3, 2008, 11:00 a.m., Building 212, Room A-157, Dieter Gruen
From: Marlene Metz <metz@anl.gov>
Date: Fri, 28 Mar 2008 08:41:12 -0500
To: msd@anl.gov

MATERIALS SCIENCE COLLOQUIUM

SPEAKER: Prof. Huili (Grace) Xing
University of Notre Dame

TITLE: "Current-carrying capacity of graphene transistors"

DATE: Thursday, April 3, 2008

TIME: 11:00 a.m.

PLACE: Building 212, Room A-157

HOST: Dieter Gruen

Refreshments will be available at 10:45 a.m

Abstract: Recently, it has been shown that charge carriers in atomically thin single-layer 2-dimensional graphene sheets can exhibit high electron (or hole) mobilities, long mean free paths, and very good electrostatic confinement of carriers. Most of these properties stem from the inherent 2D nature of the crystal, and the unique conical zero-gap bandstructure that result from the sp2-hybridized bonds. In spite of rapid advances in the field, not much interest has been directed towards understanding the high-field transport properties (saturation currents) in graphene. Since graphene sheets and nano-ribbons (GNRs) are being touted as attractive replacements for carbon nanotubes (CNTs) for transistor applications, it is worthwhile investigating the high-field current-carrying capacity of these materials. We have used a simple model for determining the fundamental current carrying capacity of 2D graphene sheets. The model builds on the seminal finding that the saturation current in the diffusive limit in CNTs is determined by zone-boundary optical-phonon back-scattering of carriers. We have derived the corresponding result for the 2D graphene case as well as for the conventional 2 dimensional electron gas (2DEG) commonly employed as channel of field effect transistors (FETs), such as Si MOSFETs and AlGaN/GaN Heterojunction FETs. Comparison of the maximum current-carrying capacity among these material systems points out the distinctive advantages of graphene sheets based electronics. The corresponding experimental efforts will also be presented.

Bio: currently Assistant Professor of Electrical Engineering at the University of Notre Dame. She obtained B.S. in physics from Peking University (1996), M.S. in Material Science from Lehigh University (1998) and Ph.D. in Electrical Engineering from University of California, Santa Barbara (2003), respectively. Her research focuses on development of III-V nitride semiconductor epitaxial growth and electronic devices, especially the interplay between the material quality and device developments. More recent research interests include fabrications of nanowire and graphene based devices for electronic, optoelectronic and bioelectronic applications.