Institute for Materials Science

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IMS Rapid Response 2017 * Recipient Guest Seminar

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University of Michigan

GaAsNBi: A Magic Alloy with Promise for Concentrating Photovoltaics

Wednesday, September 27, 2017
10:30 - 11:30 am
Sig Hecker Conference Room (TA-03 Bldg 32 - Room 134)

Abstract: Due to their significant bandgap narrowing, dilute nitride alloys are ideal for concentrating photovoltaics expected to power the next generation. However, N-related point defects often lead to degraded minority carrier transport properties and optical efficiencies. For example, in GaAsN, it has been suggested that N shares an arsenic site with either arsenic or another N atom, often termed (N-As)As or (N-N)As split interstitials. , Co-alloying of GaAsN with larger elements, such as indium, antimony, and/or bismuth, allows lattice-matching to GaAs or Ge substrates. Of particular interest is GaAsNBi, which is expected to provide the largest bandgap reduction, with the lowest concentration of N-related point defects. In this talk, we discuss molecular-beam epitaxy of GaAsNBi alloys, identifying arsenic tetramer-enhanced bismuth incorporation and bismuth-flux enhanced nitrogen incorporation. We describe our combined computational-experimental ion beam studies which reveal both bismuth and nitrogen substitutions for arsenic, along with nitrogen-arsenic pair formation at arsenic dangling bonds. Finally, we discuss our discovery of the “magic” bismuth to nitrogen ratio needed for lattice-matching to GaAs, our recent observations of surface-reconstruction-dependent atomic ordering of the alloys, and our recent measurements of the optoelectronic properties of alloy layers and quantum wells. This work was supported by the National Science Foundation (Grant No. DMR 1410282), the Center for Integrated Nanotechnologies, jointly operated by Los Alamos and Sandia National Laboratories for the U.S. Department of Energy (DoE), and the Office of Science Graduate Student Research Program, administered by the Oak Ridge Institute for Science and Education for the U.S. DoE.

Bio: Rachel S. Goldman is a professor of MSE, Physics, and EECS at UM. She received degrees from UM (B.S. Physics, 1988), Cornell (M.S. Applied Physics, 1992), and UC-San Diego (PhD Materials Science, 1995). Following her PhD, she was a postdoctoral fellow in Physics at Carnegie Mellon. In 1997, she joined the UM faculty as the Dow Corning Assistant Professor. She received the Peter Mark Memorial Award from the AVS in 2002, the Ted Kennedy Family Team Excellence Award from UM in 2004, the Augustus Anson Whitney Fellowship from the Radcliffe Institute in 2005, and the Monroe-Brown Foundation Service Excellence Award from UM in 2011. Goldman was elected Fellow of APS and AVS in 2012, and received the Distinguished Faculty Achievement Award from UM in 2016. At UM, she is currently Associate Director of Applied Physics, and has served as Education Director for the NSF Materials Research Science and Engineering Center, Associate Director of the DoE Energy Frontiers Research Center, and Graduate Chair of Materials Science and Engineering. Goldman is Associate Editor of the Journal of Applied Physics and has held editorial positions for the Bulletin of the Materials Research Society, the Journal of Electronic Materials, the Journal of Vacuum Science and Technology, and Thin Solid Films. Goldman recently joined the CINT Scientific Advisory Committee. She has served on the AVS Board of Directors (2005-2008) and as an AVS Trustee (2008-2011); she is active in committee leadership and symposium organization for MRS, TMS, and APS.

To be on Prof. Goldman's Agenda, to participate in the Early Career Lunch, or for general information contact:
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