2016 NSF-AFOSR-ARO-DTRA Workshop on Reproducible Advanced Technologies for Next-Generation Nano/Quantum Devices

Day 1

8.00 – 8.30 Introduction: Dimitris Pavlidis (NSF), Samir El-Ghazaly (NSF)

Ken Goretta (AFOSR), Enrico Bellotti (BU)

8.30 – 10.30 **Plenary Session** 1 **(<25+5+min each)**

Device Simulation and Design

Plenary 1 *Simulation Challenges for Creating Robust Design Environments from Quantum Devices to Heterogeneous Integration*
John Albrecht
Michigan State University

Plenary 2 *Revealing hidden secrets of nanocrystals, interfaces and surfaces by advancing dose-controlled atomic resolution electron microscopy.*
C. Kisielowski
Lawrence Berkeley National Laboratory, Berkeley

Material Growth and Characterization

Plenary 3 *Scientific challenges and opportunities in GaN-based materials and new oxides*
James Speck
University of California, Santa Barbara

Plenary 4 *Reproducible Molecular Beam Epitaxy for Current-Generation Nano-Quantum Devices*
James C. M. Hwang
Lehigh University

10.30 – 10.45 **Break**

10.45 – 12.45 **Plenary Session 2**

Device Processing and Characterization

Plenary 5 *Nanoimprint-Based, Large-area, High-throughput Nanomanufacturing – A Key Driver for Nanotechnology Research and Commercialization".*
Stephen Y. Chou
Joseph C. Elgin Professor of Engineering
Princeton University

Plenary 6 *Nanomaufacturing*
Hanchen Huang
Northeastern University

Manufacturing

Plenary 7 *Manufacturing of nano-electronic devices: Challenges and Opportunities in Commercialization*
Peter Burke
University of California, Irvine

Plenary 8 *Searching for the Genetic Code for Reproducible Nano/Quantum Devices*
Huili Grace Xing,
School of Electrical and Computer Engineering
Department of Materials Science and Engineering
Cornell University

12.45 – 13.45 **Lunch** and Change to Breakout Rooms

13.45 – 14.45 **Breakout Session** Presentations **(<10+5+ min each) 4 x Talks/breakout session**

Breakout 1: (Device Simulation and Design)

Moving Device Science to Systems Technology: the NEEDS Experience
Mark Lundstrom
Purdue University

Controlling surfaces and parasitics for reliability by design
Michael Shur,
Patricia W. and C. Sheldon Roberts Professor
Electrical, Computer, and Systems Engineering
Physics, Applied Physics, and Astronomy
CII 6015 Rensselaer Polytechnic Institute

Using topological protection to make reproducible nanodevices
William Vandenberghe
Department of Materials Science and Engineering, University of Texas at Dallas

Emerging Nanoelectronics for Sensing and Hardware Security
Michael Niemier
Department of Computer Science and Engineering
University of Notre Dame

Breakout 2: (Material Growth and Characterization)

Chemical vapor deposition pathways to reproducible 2D films
Joan Redwing

Department of Materials Science and Engineering and 2D Crystal Consortium
Penn State University, University Park, PA

Challenges in controlling alloy composition and doping across the wafer
Zlatko Sitar
North Carolina State University

Characterizing Nanomaterials and Devices via Raman Imaging: Case Studies in Diamond, Van der Waals, and Phase Change Materials
Dr. Glen Birdwell
U.S. Army Research Laboratory
Adelphi, Maryland

Present and future needs for functional imaging at the nanoscale
Laurene Tetar
University of Central Florida

Breakout 3: (Device Processing and Characterization)

Scalable Fabrication of Multiscale Polymer Materials Incorporating Nanostructures over Large Surface Areas
Xuanhong Cheng
Lehigh University (Dimitris to contact)

Contacts and Thin-Film Deposition Processes for Next-Generation Devices
Suzanne Mohney,
Penn State

Effects of nonuniformity on future nanopillar quantum-cascade lasers
Benjamin Williams and Benjamin Burnett
UCLA
& Topological spintronics structures and devices
Kang Wang
UCLA

Challenges of the extremes in the pursuit of a new form of carbon nanostructure - Diamond Nanowires
Jimmy Xu
Brown University

Breakout 4: (Manufacturing)

"Nano-manufacturing for next generation Sensing, Computing, and Trust at Sandia National Laboratories"
Clark Highstrete,
Sandia National Laboratories

Industry Needs for Manufacturing and Commercialization using Advanced Nano Materials and Devices
C.Y. Sung
Lockheed Martin

Next-generation device opportunities and manufacturing challenge
Jeong Moon
HRL Laboratories

14.45 – 15.00 Break

15.00 – 16.00 Breakout Discussions

16.00 – 16.45 Preparation of Summary/Conclusions of day 1 Presentations

Day 2

8.15 – 8.30 General Remarks in Common Room

8.30 – 9.30 Summary/Conclusions of day 1 Presentations (20 min each)

Breakout 1: Device Simulation and Design

Breakout 2: Material Growth and Characterization

Breakout 3: Device Processing and Characterization

Breakout 4: Manufacturing

9.30 – 10.30 **Breakout Presentations** in Common Room (<10+5+ min each)

Breakout 1: Device Simulation and Design

Does perfection in quantum performance require perfection in qubit fabrication?
Andrew Cleland
University of Chicago

Organizing Matter in 2D and 3D using the Information in DNA
Nadrian C. Seeman
Department of Chemistry
New York University, New York, NY

Breakout 2: Material Growth and Characterization

Material Growth and Characterization for the Next Generation of Reproducible/Reliable Nano-Quantum Devices
Aris Christou
Materials Science and Engineering
University of Maryland
College Park, MD 20742

Scalable synthesis of 2D layered materials for versatile properties and applications
Wongbong Choi
University of North Texas

10.30 – 11.00 Break and Photo

11.00 – 12.00 Breakout Presentations in Common Room (<10+5+ min each)

Breakout 3: Device Processing and Characterization

Simulation for Advanced, Reproducible, and Reliable
Mark Law
University of Florida

Predictive modeling of nanostructures in low dimensions
Boris I. Yakobson
Rice University

12.00 – 13.00 Lunch and Change to Breakout Rooms

13.00 – 14.30 Breakout Session Group Meetings and Presentation – Report Preparation

Breakout 1: Device Simulation and Design

Breakout 2: Material Growth and Characterization

Breakout 3: Device Processing and Characterization

Breakout 4: Manufacturing

14.30 – 14.45 Break and Change of Breakout to Common Room

14.45 – 15.45 Summary/Conclusions of day 2 Presentations (20 min each)

Breakout 1: Device Simulation and Design

Breakout 2: Material Growth and Characterization

Breakout 3: Device Processing and Characterization

Breakout 4: Manufacturing

15.45 – 16.30 **General Conclusions**