

## BRUCE J. HINDS III

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### Education:

**Ph.D.** Inorganic Chemistry; Northwestern University, June 1996

**M.S.** Chemistry; Northwestern University, December 1992

**B.S.** Chemistry; Harvey Mudd College, May 1991

### Research Experience:

**William Bryan Professor of Materials Engineering** (2011-present) **Associate Professor** (2007 – 2011) **Assistant Professor** (2001-2007): “Functional Materials at the Nano-Scale” University of Kentucky, 2001-Present. Primary faculty appointment in Materials Engineering Program, Dept. of Chemical and Materials Engineering. Joint-Appointment Dept. of Chemistry July 1 2003-present. Assisting Director of the Center for Nanoscale Science and Engineering.

**Post-Doctoral Fellowship Research:** “Charge Storage Mechanism in Nano-Crystalline Si Based Single-Electron Memories” JSPS/NSF Research Fellowship, Tokyo Institute of Technology, 1998-2001. Host Professor: Shunri Oda.

**Post-Doctoral Research:** “Si/SiO<sub>2</sub> Interface Stability and Optimization.” Department of Physics, North Carolina State University, 1996-1998. Host Professor: Gerald Lucovsky.

**Graduate Research Thesis:** “Ti-Ba-Ca-Cu-O Thin Films for Superconducting Electronics: Precursor Performance, Deposition Mechanism, Phase Formation, and Trilayer Structures by Metal-Organic Chemical Vapor Deposition.” Northwestern University, 1991-1996. Ph.D. Advisor: Tobin Marks.

**Undergraduate Research Thesis Project:** “Kinetic Studies of Ester Hydrolysis at Transition Metal Centers within Perfluorosulfonate Films.” Harvey Mudd College, 1990-1991. Advisor: Hal VanRyswyk.

### Awards and Honors:

Kavli Frontiers of Science Fellow, National Academy of Science 2010

Elected vice-chair Gordon Conference ‘Membranes: Materials & Processes 2012’, Chair 2014

Presidential Early Career Award (PECASE, NIH) 2009

NSF Early Career Award, 2004

Japanese Society for the Promotion of Science (JSPS) Post-Doctoral Fellowship Award, 1998

**Publications:****From research activities at the University of Kentucky (\* corresponding author):**

62. 'Photocurrent Enhancement of Copper (II) Phthalocyanine film on Nano-gap electrode generated by the exposed edge of Au/Al<sub>2</sub>O<sub>3</sub>/Au structure' Bing Hu, B. J. Hinds\* *IEEE Transactions Nanotechnology* In-press
61. "Pt monolayer deposition onto carbon nanotube mattes with high electrochemical activity" Xin Su, Xin Zhan, Bruce J. Hinds\* *J. Mater. Chem.* In press DOI:10.1039/C2JM15395E
60. "Electrochemical Water Oxidation with Carbon-Grafted Iridium Complexes" deKrafft, K.; Wang, C.; Xie, Z.; Su, X.; Hinds, B.J.; Lin, W.\* *ACS Appl. Mater. & Interfaces* In-press
59. "Electrophoretically Induced Aqueous Flow through sub-Nanometer Single Walled Carbon Nanotube Membranes" Ji Wu, Karen Gerstandt, Hongbo Zhang, Jie Liu, and Bruce. J. Hinds\* *Nature Nano* **2012** 7(2) 133-39.
58. 'Dramatic Transport Properties of Carbon Nanotube Membranes for a robust protein channel mimetic platform' B.J. Hinds\* *Curr. Opin. in Solid. State & Mater. Sci.* **2012** 16(1) 1-9.
57. 'Highly Efficient Electro-osmotic Flow through Functionalized Carbon Nanotubes Membrane' Ji Wu, Karen Gerstandt, Mainak Majumder, B.J. Hinds\*, *RCS Nanoscale* **2011** 3(8) 3321-28
56. 'Simulation of steady state methanol flux through a model carbon nanotube catalyst support' Jacob Goldsmith and B. J. Hinds\* *J. Phys. Chem. C* **2011** 115(39) 19158-64
55. 'Mass Transport through Carbon Nanotube Membranes in three different regimes: ionic diffusion, gas, and liquid flow' Mainak Majumder, Nitin Chopra, B.J. Hinds\* *ACS Nano* **2011** 5(5) 3867-3877
54. 'Selective Lateral ZnO Nanowire Growth by Surface Diffusion on nm-Scale Patterned Alumina on Silicon' Bing Hu, Nitin Chopra, Pawan Tyagi, B. J. Hinds\* *J. Mater. Res.* **2011** 26(17) 2224-31
53. 'Electrophoretic Transport of Biomolecules through Carbon Nanotube Membranes' Xinghua Sun, Xin Su, Ji Wu, B. J. Hinds\* *Langmuir* **2011** 27(6) 3150-56.
52. 'Catalytic Activity of Ultrathin Pt Films on Aligned Carbon Nanotube Arrays' Xin Su, Ji Wu, B.J. Hinds\* *Carbon* **2011** 49(4) 1145-50.
51. 'Nano-gap electrodes formed at the exposed edge of Au/SAM/Al<sub>2</sub>O<sub>3</sub>/Au tunnel structures grown by atomic layer deposition' Bing Hu, Jingyuan Yao, B. J. Hinds\* *Appl. Phys. Letters* **2010** 97(20) 203111.
50. "Programmable transdermal drug delivery of nicotine using carbon nanotube membranes" J. Wu, K.S. Paudel, C.L. Strasinger, D. Hamell, Audra L. Stinchcomb\*, B. J. Hinds\* *Proc. Nat. Acad. Sci.* **2010** 107(26) 11698-11702. (Nature Materials Highlight)
49. "Mechanism of ultrathin tunnel barrier failure due to mechanical-stress-induced nanosized hillocks and voids" P. Tyagi and B.J. Hinds *J. Vacuum Sci. & Techn. B* **2010** 28, 517-521.
48. "Towards mimicking natural protein channels with aligned carbon nanotube membranes for active drug delivery" Majumder, M; Stinchcomb, A; Hinds BJ\* *Life Sciences* **2010** 86, 563-68.
- 47 "Carbon Nanotube Membranes for use in the Transdermal Treatment of Nicotine Addiction and Opioid Withdrawal Symptoms." C.L. Strasinger, N. N. Scheff, J. Wu, B. J. Hinds, Audra L. Stinchcomb\*, *Substance Abuse: Research and Treatment* **2009**:3 31-39
46. "Enhanced Electro-Static Modulation of Ionic Diffusion through Carbon Nanotube Membranes by Diazonium Grafting Chemistry" Majumder, M; Keis, K M.; Zhan, X; Hinds, B.J \* *J. Membr. Sci.* **2008**, 316, 89-96.
45. "A Blueprint for a Nanoscale Pump" Hinds, B\* *Nature Nanotechnology* **2007**, 2, 673-674

44. "Functional one-dimensional nanomaterials: Applications in nanoscale biosensors" Chopra, N; Gavalas, VG; Hinds, BJ; Bachas, LG\*; *Analytical Letters* **2007**, 40, 2067-2096.
43. "Voltage Gated Carbon Nanotube Membranes" Majumder, M.; Zhan, X; Andrews, R; Hinds, B.J \* *Langmuir* **2007**; 23(16); 8624-8631.
42. "Kinetic Study of Copper Oxide Nanowire Growth from the Edges of Thin Film Multilayer Structures" Chopra, N; Hu, B.; Hinds B.J\* *J. Mater. Res.* **2007** 22, 2691-2699
41. "Carbon Nanotube Based Biomimetic Membranes: Mimicking Protein Channels Regulated by Phosphorylation" Nednoor, P; Gavalas, V.G; Chopra, N; Hinds, B.J.\*, Bachas, L.G.\* *J. Mater. Chem.* **2007** 17, 1755-1757
40. "Molecular Electrodes at the exposed edge of metal-insulator-metal trilayer structures" Tyagi, P.; Li, D.; Holmes S.M.; Hinds, B.J.\* *J. Amer. Chem. Soc.* **2007** 129, 4929-4938.
39. "Nanoscale hydrodynamics: Enhanced flow in carbon nanotubes" Majumder, M.; Chopra, N.; Andrews, R; Hinds, B.J \* *Nature* **2005**, 438, 44.
38. "Raman Spectroscopic Investigation of Gas Interactions with an Aligned Multiwalled Carbon Nanotube Membrane" Matranga, C\*; Bockrath, B; Andrews, R; Chopra, N, Hinds, BJ *Langmuir* **2006**; 22, 1235-1240.
37. "Effect of Tip Functionalization on Transport through Vertically Oriented Carbon Nanotube Membranes" Majumder, M.; Chopra, N.; Hinds, B.J \* *J. Amer. Chem. Soc.* **2005**; 127, 9062-9070.
36. "Reversible Biochemical Switching of Ionic Transport through Aligned Carbon Nanotube Membranes" Nednoor, P.; Chopra, N.; Gavalas, V.; Bachas, L.G.\*; Hinds, B.J.\* *Chem. Mater.* **2005** 17, 3595-3599.
35. "Bi-functional Carbon Nanotubes by Sidewall Protection" Chopra, N; Majumdar, M; Hinds, B.J.\* *Adv. Funct. Mater.* **2005** 15, 858-64.
34. "Effect of Incident Angle in Suspended Carbon Nanotube Shadow Lithography" Chopra, N; Xu, W; De Long, L.E.; Hinds, B.J\* *Nanotechnology* **2005** 16, 133-36.
33. "Catalytic size control of multiwalled carbon nanotube diameter in xylene chemical vapor deposition process" Chopra, N., Hinds, B.J.\* *Inorg. Chem. Acta* **2004** 357, 3920-3926.
32. "Aligned Multiwalled Carbon Nanotube Membrane" Hinds, B.J.\*; Chopra, N.; Andrews, R.; Gavalas, V.; Bachas L. *Science* **2004** 303 62-65.
31. "Control of Multiwalled Carbon Nanotube Diameter by Selective Growth on the Exposed Edge of a Thin Film Multilayer Structure" Chopra, N. Kichambare, P.D. Andrews, R. and Hinds, B.J.\* *Nanoletters* **2002** 2(10) 1177-1181.

**Submitted publications:**

65. 'Low Voltage Electroporation of endothelial cells using thin film electrodes in nanoporous alumina membranes' X. Sun Z.W. Johnson, P. Hoblitzell, WL Mercke, K.W. Anderson, B.J Hinds\* *J. Biomaterials Applications* submitted April. 2012
64. 'Fouling Characteristics and Electrochemical Recovery of Carbon Nanotube Membranes' X. Sun\*, Ji Wu, Z. Chen, X. Su and B.J. Hinds ACS Nano submitted March 2012
63. 'Programmable Transdermal Clonidine Delivery through Voltage Gated Carbon Nanotube Membranes Clonidine' " C.L. Strasinger, J. Wu, K.S. Paudel, Nichole Scheff, D. Hamell, Raghotham R. Pinninti, B. J. Hinds\*, Audra L. Stinchcomb\* *J. Controlled Release*, revision submitted Feb. 2012.

**Citation data (as of 1/19/12)**

Career (1992-present):

1740 citations (1621 non-self), H-index 20

At Univ. of Kentucky July 2001-present:

1085 citations, (1007 non-self), H-index 11

**Funded Research Activity:**

**Approximately \$4.7M for Hinds' lab attributed activities of \$16.4M total with collaborations**

**As PI**

“Molecular Transporters” DARPA 6/1/09-02/17/12 \$688,000 (82%, co-I Lin UNC-CH)

“R01: Gated Carbon Nanotube Membrane Transdermal Drug Delivery” NIH (co-I Stinchomb) 7/1/06-6/31/11; PECASE award extension 7/1/11-1/31/15 (sole PI, 100%)

“Aligned Carbon Nanotube Membranes for Forward Osmosis Power Generation” Statkraft Corp., Norway 7/1/08-6/31/12 concluded

“CAREER: Aligned Carbon Nanotube Composite Array as Permeable Membrane” NSF, 4/1/04-9/30/10 Concluded

“Controlled Growth of Single-Walled Carbon Nanotubes for a Scalable Sub-Nanometer Lithography Process with Applications Towards Molecular Quantum Cryptology” AFOSR, sole-PI 04/01/02 - 03/31/06 Concluded

“Synthetic Route for Carbon Nanotube Based Permeable Membrane” Kentucky Science and Engineering Foundation sole PI B.J. Hinds 04/01/02-12/31/02 Concluded.

**As co-PI**

*IDC- calculated from % share of IDC incentive distribution*

*#PIs- for instrument or large infrastructure % calculated from total number of PI/co-PI*

“Advanced Materials Relating to Applications in Epitaxial Thin Films and Device Structures” NSF EPSCoR subcontract of ‘EPSCoR RII: Transforming Kentucky's New Economy’ (P.I. G. Cao, 5 co-I) 9/1/08-8/31/13 (UK portion) (17% #PIs)

“IGERT: Building Interdisciplinary Leadership Through a Program on Engineered Bioactive Interfaces and Devices” NSF (co-PI Hinds, PI Kim Anderson, 14 faculty participants) 7/01/07-6/30/11 (6.3% #PIs)

“DOE EPSCoR: Nanoscale Materials and Architectures for Energy Conversion” DOE (3 co-PI, PI Steve Rankin) 7/01/07-6/30/09 (25% #PIs)

“NIRT: Novel One-Dimensional Horizontally Aligned Array of Nanopores: Nanoscale Fabrication for Molecular and Electronic Devices” NSF (3 co-PI, PI Zhi Chen) 7/1/06-6/31/11 (20% IDC)

“Advanced Carbon Nanotechnology Consortium” ARO (P.I. J. Davidson, Vanderbilt \$22M (4 universities, co-PI Janet Lump (7 UK investigators) \$5M for UK) 1/1/03- 4/31/09 subcontract to B. J. Hinds (50% subcontract) Concluded

“Kentucky Partnership for Nanoscale Electronics and Biotechnology” NSF EPSCoR (P.I. Z. Chen, one of 15 co-I) 7/1/05-6/31/08 (6.7% #PIs) Concluded

“Integrated Material Architectures: From Nanoscale Studies to Microdevice Development” DOE EPSCoR (PI K. Walsh Univ. of Louisville) 7/1/03-6/31/06 subcontract to B.J. Hinds Concluded

“Nano-Scale Engineering Education for Undergraduates” NSF Nanoscale Science and Engineering Centers (4 co-PI, PI M.P. Meguc) 06/01/03-05/31/04 (20% IDC) Concluded

- “Stability, Dynamics and Switching of Magnetic Nanostructures” Kentucky Science and Engineering Foundation (1 co-PI. PI L. DeLong) 06/01/03-5/31/05 (40% IDC) Concluded
- “Investigation of the Stability and Dynamics of Nanoscale Magnetic Order with Superconducting Probes” DOE (1 co-PI. PI Lance DeLong) 4/1/04-3/31/04 (15% IDC) Concluded
- ‘A Novel Method for Fabrication and Characterization of Nano-Scale Heterojunctions’ Kentucky Science and Engineering Foundation (3 co-PIs. PI V.J. Singh) 06/01/03-5/31/05 (12.5% IDC) Concl.
- “MRI Acquisition of Instrumentation for Thermal Characterization of Materials” NSF Major Research Equip. Prog. (4 co-PIs. PI John Selegue) 06/01/03-5/31/05 (20% #PIs) Concluded

**Publications continued**

**From previous research activities outside of UKY:**

30. “Emission Lifetime of Polarizable Charge Stored in Nano-Crystalline Si Based Single-Electron Memory” Bruce J. Hinds, Takayuki Yamanaka and Shunri Oda. *J. Appl. Phys.* **2001**, 90(12) 6402-6408.
29. “Two-Gate Transistor for the Study of Si/SiO<sub>2</sub> Interface in SOI Nano-Channel and Nanocrystalline Si Memory Device” Hinds, B.J.; Nishiguchi, K.; Dutta, A.; Yamanaka, T.; Hatanani, S.; Oda, S.; *Jap. J. Appl. Phys.* **2000**, 39(7B), 4637-4641.
28. “Room Temperature Single-Electron Narrow-Channel Memory with Silicon Nanodots Embedded in SiO<sub>2</sub> Matrix” Yun, F.; Hinds, B.J.; Hatatani, S.; Oda, S.; *Jap. J. Appl. Phys.* **2000**, 39(8A), L792-795.
27. “Study of Structural and Optical Properties of Nanocrystalline Silicon Embedded in SiO<sub>2</sub>” Yun, F.; Hinds, B.J.; Hatatani, S.; Oda, S.; Zhao, Q.X.; and Willander, M.; *Thin Solid Films* **2000** 375(1-2) 137-141.
26. “Investigation of Postoxidation Thermal Treatments of Si/SiO<sub>2</sub> in Relationship to the Kinetics of Amorphous Si Suboxide Decomposition” Hinds, B.J.; Wang, F.; Wolfe, D.M.; Hinkle, C.L.; Lucovsky G.; *J. Vac. Sci. Technol. B* **1998**, 16(4), 2171.
25. “Study of SiO<sub>x</sub> Decomposition Kinetics and Formation of Si Nanocrystals in a SiO<sub>2</sub> Matrix” Hinds, B.J.; Wang, F.; Wolfe, D.M.; Hinkle, C.L.; Lucovsky, G.; *J. Non-Crystalline Solids* **1998**, 227-230(1), 507.
24. “Minimization of Suboxide Transition Regions at Si-SiO<sub>2</sub> Interfaces by 900°C Rapid Thermal Annealing” Lucovsky, G.; Banerjee, A.; Hinds, B.; Claflin, B.; Koh, K.; Yang, H.; *J. Vac. Sci. Technol. B* **1997**, 15(4), 1074.
23. “New Approach to Preparing Smooth Si(100) Surfaces: Characterization by Spectroellipsometry and Validation of Si/SiO<sub>2</sub> Interfaces Properties in Metal-Oxide-Semiconductor Devices” Schmidt, D.; Niimi, H.; Hinds, B.J.; Aspnes, D.E.; Lucovsky, G.; *J. Vac. Sci. Technol. B* **1996**, 14(4), 2812.
22. “Thin Films for Superconducting Electronics. Precursor Performance Issues, Deposition Mechanisms, and Superconducting Phase Formation-Processing Strategies in the Growth of Tl<sub>2</sub>Ba<sub>2</sub>Ca<sub>1</sub>Cu<sub>2</sub>O<sub>8</sub> Films by Metal Organic Chemical Vapor Deposition” Hinds, B. J.; McNealy, R.J.; Studebaker, D.B.; Marks, T.J.; Hogan T.P.; Schindler, J.L.; Kannewurf, C.R.; Zhang, X.F.; Miller. D.J. *J. Mater. Res.* **1997**, 12(5), 1214.
21. “MOCVD Routes to Tl-2212/MgO/Tl-2212 Trilayers. Preliminary Observations On Growth and Microstructural/Electrical Properties.” Hinds, B.J.; McNeely, R.J.; Chen, J.; Dias, C.; Studebaker, D.B.; Marks, T.J.; Hogan, T.P.; Schindler, J.L.; Kannewurf, C.R.; *J. Alloys and Compounds.* **1997**, 351, 328.

20. "Efficient Route to  $TlBa_2Ca_2Cu_3O_{9+x}$  Thin Films by Metal-Organic Chemical Vapor Deposition Using TIF as a Thallination Source" McNeely, R.J.; Belot, J.A.; Hinds, B.J.; Marks, T.J.; Schindler, J.L.; Chudzik, M.P.; Kannewurf, C.R.; Zhang, X.F.; Miller, D.J.; *Appl. Phys. Lett.* **1997**, 71(9), 1243.
19. "MOCVD Routes to  $Tl_2Ba_2Ca_{n-1}Cu_nO_{4+2n}$  Superconductor and Dielectric Insulator Thin Films" Hinds, B.J.; Studebaker, D.B.; Chen, J.; McNeely, R.J.; Han, B.; Schindler, J.L.; Hogan T.P.; Kannewurf, C.R.; Marks, T.J.; *J. de Physique IV*, **1995**, C5, C391.
18. "Metal-Organic Chemical Vapor Deposition/Open Flow Thallium Annealing Route to Epitaxial  $Tl_2Ba_2Ca_2Cu_3O_{10}$  Thin Films" Hinds, B.J.; Schultz, D.L.; Nuemayer, D.A.; Han, B.; Marks T.J.; Wang, Y.Y.; Dravid, V.P.; Schindler, J.L.; Hogan T.P.; Kannewurf, C.R.; *Appl. Phys. Lett* **1994**, 65(2), 213.
17. "Metal-Organic Chemical Deposition Route to Epitaxial  $Tl_2Ba_2Ca_2Cu_3O_{10}$  Thin Films" Hinds, B.J.; Marks T.J. Contribution in Glocker, D.A.; Shah, S.I., Ed. *Handbook of Thin Film Process Technology*, IOP Publishing Inc.: Philadelphia PA. **1996**.
16. "New Precursors for Barium MOCVD.  $\beta$ -Ketoiminate Complexes Containing Appended Polyether "Lariats" Schulz, D.L.; Hinds, B.J.; Stern, C.L.; Marks, T.J.; *Inorg. Chem.* **1993**, 32, 249.
15. "New Structural Aspects of  $Tl_2Ba_2Ca_1Cu_2O_y$  Epitaxial Thin Films Grown by MOCVD on  $LaAlO_3$ " Zhang, X.F.; Sung, Y.S.; Miller, D.J.; Hinds, B.J.; McNeely, R.J.; Studebaker, D.L.; Marks, T.J.; *Physica C*, **1997**, 275, 146.
14. "Volatility by Design. Synthesis and Characterization of Polyether Adducts of Bis(1,1,1,5,5,5-hexafluoro-2,4, pentanedionato)barium and Their Implementation as Metal-Organic Chemical Vapor Deposited Precursors" Belot, J.A.; Nuemayer, D.A.; Reedy, C.J.; Studebaker, D.B.; Hinds, B.J.; Stern, C.L.; Marks, T.J.; *Chem Mater.* **1997**, 9, 1638.
13. "Characteristic Doping-Dependent Properties of HTS Cuprate Thin Films Prepared via MOCVD" Schindler, J.L.; Duran, C.R.; Dimeo, F.; Wessels, B.W.; Hinds, B.J.; McNeely, R.J.; Marks, T.J.; Kannewurf, C.R.; *J. Alloys and Compounds.* **1997**, 351, 347.
12. "The Growth of (001)  $YBa_2Cu_2O_{(7-d)}$  Thin Films on (001) MgO by Pulsed Organo-Metallic Beam Epitaxy with Controlled In-Plane Orientation" Buchholz, D.B.; Lei, J.S.; Mahajan, S.; Markworth, P.R.; Chang, R.P.H.; Hinds, B.; Marks, T.J.; Haung, Y.; Merkle, K.L.; *J. Alloys and Compounds.* **1997**, 351.
11. "Tl-Ba-Ca-Cu-O Thin Films for Superconducting Electronics: Precursor Performance, Deposition Mechanism, Phase Formation, and Trilayer Structures by Metal-Organic Chemical Vapor Deposition" Hinds, B.J. Ph.D. Dissertation, Northwestern University, **1996**.
10. "In-plane Orientation Control of (001)  $YBa_2Cu_3O_{7-x}$  Grown on (001)MgO by Pulsed Organometallic Beam Epitaxy" Buccholz, D.B.; Lei, J.S.; Mahajan, S.; Markworth, P.R.; Chang, R.P.H.; Hinds, B.; Marks, T.J.; Schindler, J.L.; Kannewurf, C.R.; Huang, Y.; Merkle, K.L.; *Appl. Phys. Lett.* **1996**, 68, 3037.
9. "Fabrication and Characteristics of Weak Links Between a- and c-Axis Normal Grains of  $YBa_2Cu_3O_{7-x}$ " Mahajan, S.; Buchholz, D.B.; Lei, J.; Chang, R.P.H.; Hogan, T., Kannewurf, C.R.; Song, S.N.; Ketterson, J.B.; Hinds, B.; Marks, T.J.; Eckstein, J.; *J. Mater. Res.* **1996**, 11(5), 1086.
8. "New Precursors for Barium Metal-Organic Chemical Vapor Deposition. In Situ Growth of Epitaxial Barium Titanate Films Using a Liquid Barium Precursor" Nuemayer, D.A.; Studebaker, D.S.; Hinds, B.J.; Stern, L.; Marks, T.J.; *Chem. Mater.* **1994**, 6, 878.
7. "Synthesis and Characterization of a New Thermally Stable and Volatile Precursor [bis(1,1,1,2,2,3,3,7,7,8,8,9,9,9-Tetradecafluoro-4,6-Nonanedionato) $_2$ •Tetraglyme] Barium(II) for

MOCVD Applications” Malandrino, G.; Fragala, I.L.; Neumayer, D.A.; Stern, C.L.; Hinds, B.J.; Marks, T.J.; *J. Mat. Chem.* **1994**, 4(7), 1061.

6. “Barium b-ketoiminate Complexes Containing Appended Ether 'Lariats'. Synthesis, Characterization, and Implementation as Fluorine-Free Barium MOCVD Precursors” Schulz, D.L.; Hinds, B.J.; Neumayer, D.A.; Stern, C.L.; Marks, T.J.; *Chem. Mater.* **1993**, 5, 1605.

5. “Transmission Electron Microscopic Characterization of Metal-Organic Chemical Vapor Deposition-Derived Superconducting  $Tl_2Ba_2Ca_1Cu_2O_x$ ” Jieguang, H.; Miller, D.J.; Schulz, D.L.; Han, B.; Neumayer, D.A.; Hinds, B.J.; Marks, T.J.; *Physica C* **1993**, 210, 97.

4. “Materials for Superconducting Electronics: *In-situ* Growth of  $PrGaO_3$  Thin Films by Metalorganic Chemical Vapor Deposition” Han, B.; Neumayer, D.A.; Schulz, D.L.; Hinds, B.J.; Marks, T.J.; *J. Vac. Soc. Technol. A* **1993**, 11(4), 1431.

3. “In Situ Growth of Epitaxial  $YAlO_3$  Thin Films by Metal-Organic Chemical Vapor Deposition” Han, B. Neumayer, D.A.; Schulz, D.L.; Hinds, B.J.; Marks, T.J.; *Chem. Mater.* **1993**, 5, 14.

2. “Crack Development in a Carbon-Carbon Laminate” Pollock, P.B.; Hinds, B.J.; Teders, R.J.; Kocher, C.G.; *Carbon* **1993**, 31(6), 992.

1. “Kinetic Studies of Ester Hydrolysis at Transition Metal Centers within Perfluorosulfonate Films” Van Ryswyk, H., Hinds, B.J.; Simmons, B.L.; Solomon, D.S.; *J. Electrochem. Soc.* **1992**, 139(11), 3098.

#### **Publications in Conference Proceedings** (peer reviewed)

“Suspended Carbon nanotubes shadow lithography: incident evaporation angle dependence” Material Research Society, Boston, December 2003 Extended abstract ‘Nontraditional Approaches to Patterning’ Editors: Y. Xia, C.D.E. Lakeman, J. Liu, S. Yang MRS Proceedings Volume EXS-2

“Simple use of  $SiO_2$  film thickness for the control of carbon nano-tube diameter during ferrocene catalyzed CVD growth” Material Research Society, Boston, December 2002 In ‘Three-Dimensional Nanoengineered Assemblies’ Editors: Thomas M. Orlando, Lhadi Merhari, David P. Taylor, Koji Ikuta, MRS Proceedings Volume 739

“Charge Storage Mechanism in Nano-Crystalline Si Based Single-Electron Memories” Bruce J. Hinds, Takayuki Yamanaka, and Shunri Oda. Material Research Society Proceedings Fall 2000, Volume 638.

“Preparation and Characterization of Silicon Nanocrystals in a  $SiO_2$  Matrix and Study of Suboxide Stability” Hinds, B.J.; Banerjee, A.; Johnson, R.S.; Lucovsky, G.; MRS Fall 1996 Conference Proceedings, Boston MA, *Mat. Res. Soc. Symp. Proc.* Vol 452.

“Low pH Chemical Etch Route for Smooth H-Terminated Si(100) and Study of Subsequent Chemical Stability” Hinds, B.J.; Aspnes, D.E.; Lucovsky, G.; MRS Spring 1997 Conference Proceedings, San Francisco CA, *Mat. Res. Soc. Symp. Proc.* Vol. 477.

“MOCVD Routes to Thin Films for Superconducting Applications. Precursor Synthesis and Film Processing Issues” Marks, T.J.; Belot, J.A.; Hinds, B.J.; Chen, J.; Studebaker, D.; Lei, J.; Chang, R.P.H.; Schindler, J.L.; Kannewurf, C.R.; *Mat. Res. Soc. Symp. Proc.* **1996**, 415, 67.

“Influence of Weak Links and Oxygen Deficiency on Electrical Properties of Bi-2212 and Tl-2212 HTS Thin Films” Schindler, J.L.; DiMeo, F.; Duran, C.R.; Hinds, B.J.; Wessels, B.W.; Marks, T. J.; Kannewurf, C.R.; *Mat. Res. Soc. Symp. Proc.* **1996**, 410, 315.

“Metal-organic Chemical Vapor Deposition of Epitaxial  $Tl_2Ba_2Ca_2Cu_3O_{10}$  Thin Films” Hinds, B.J.; Schindler, J.L.; Han, B.; Nuemayer, D.A.; DeGroot, D.C.; Marks T.J.; Kannewurf, C.R.; *Mat. Res. Soc. Symp. Proc.* **1994**, 335, 273.

### **Presentations:**

#### **Invited:**

‘Dramatic nano-fluidic properties of carbon nanotube membranes and their use in programmable drug delivery’, Dept. Mater. Sci. Eng., Northwestern Univ., May 10 2011

‘Dramatic nano-fluidic properties of carbon nanotube membranes and their use in programmable drug delivery’, PacifiChem, Honolulu, Dec. 16 2010

‘Programmed transdermal delivery of addictive substances through voltage gated carbon nanotube membranes’ American College of Neuropsychopharmacology, Orlando Dec. 5 2010

‘Dramatic nano-fluidic properties of carbon nanotube membranes and their use in programmable drug delivery’ Univ. of Akron, Nov 18 2010

‘Kavli Frontiers of Science Symposia Faculty Participant’ National Academy of Sciences, Irvine CA, Nov. 4 – 6 2010

‘Dramatic nano-fluidic properties of carbon nanotube membranes’ Korean CNT-membrane Forum’ full travel support, Seoul National University, Oct. 14-15<sup>th</sup> 2010

‘Dramatic nano-fluidic properties of carbon nanotube membranes and their use in programmable drug delivery’ Dept. of Mech. Engr., Ohio State Univ. Oct. 3, 2010

‘Dramatic nano-fluidic properties of carbon nanotube membranes and their use in programmable drug delivery’, Dept. of Chem. Engr., Virginia Polytechnic Institute, Sept 22, 2010

‘Workshop: Emerging Membrane Materials and Manufacturing methods’ North American Membrane Society, July 18, 2010 (highest paid attendance of offered workshops)

‘Highly efficient electro-osmotic flow through carbon nanotube membranes’ Fundamentals of Nanotechnology, Salt Lake City, April 29, 2010

‘Programmed transdermal drug delivery with carbon nanotube membranes: using dramatic nano-scale properties for addiction treatment’ Department of Chemistry, Duke University April 12, 2010

‘Active carbon nanotube membranes for programmed transdermal addiction treatment’ Society for Research on Nicotine and Tobacco (NIH-NIDA sponsored) Feb. 24, 2010

‘Aligned Carbon nanotubes: flow enhancement and gatekeeper activity’ European Membrane Society Meeting, Mount Pellier Fr. Sept. 1-10, 2009 (keynote talk, emerging membrane materials workshop, young investigator workshop)

‘Workshop: Emerging Membrane Materials and Manufacturing methods’ North American Membrane Society, June 22 2009 (highest paid attendance of offered workshops)



‘Carbon Nanotube Membranes for Pressure Retarded Osmotic Power Generation’ Statkraft Corporation, Oslo Norway June 5 2009

‘Aligned Carbon nanotubes: flow enhancement and gatekeeper activity’ IGERT Seminar, Univ. Massachusetts Amherst, May 7 2009

‘Aligned Carbon nanotubes: flow enhancement and gatekeeper activity’ Lawrence Berkeley Laboratory March 5 2009

‘Aligned Carbon nanotubes: flow enhancement and gatekeeper activity’ Dept. Seminar, Chemistry, Indiana Univ. Oct 7 2008

‘Workshop: Emerging Membrane Materials and Manufacturing methods’ Int. Congress on Membranes, Honolulu HI, July 13-18 2008 (highest paid attendance of offered workshops)

‘Aligned Carbon nanotubes: flow enhancement and gatekeeper activity’ NanoTR4, Istanbul Turkey June 9-12 2008

‘Aligned Carbon Nanotube Membranes with Electro-Steric Gatekeeper for Transdermal Chrono-Therapy’, NIH-NIDA Rockville MD June 3 2008

“Nanofunctional Materials” Department Seminar, Chemical Engr., Univ. Washington, May 20 2008

“Carbon Nanotube Membranes: gatekeeper functionality and enhanced fluid flow” Frontiers of Nanotechnology, Salt Lake City April 22 2008

“Carbon Nanotube Membranes: gatekeeper functionality and enhanced fluid flow” ACS spring Meeting, Tobin Marks Inorganic Award Session New Orleans, March 25 2008

“Carbon Nanotube Membranes: gatekeeper functionality and enhanced fluid flow” UIUC, Feb. 8 2008

“Carbon Nanotube Membranes: gatekeeper functionality and enhanced fluid flow” Dept. Chem. Eng. Rice Univ., Nov. 15 2007

“Carbon Nanotube Membranes: gatekeeper functionality and enhanced fluid flow” AIChE National meeting Tutorial Workshop Nov. 2007

“Carbon Nanotube Membranes” Diamond 2007, Berlin Germany, 9-14 Sept. 2007

“Carbon Nanotube Membranes” Millipore Corporation Sept. 21 2007

“Carbon Nanotube Membranes” ACS National meeting, Polymer Division, Sept. 2007

“Carbon Nanotube Membranes” IBM Almaden, May 24 2007

“Carbon Nanotube Membranes: gatekeeper functionality and enhanced fluid flow” *Keynote Speaker* 9th International Conference on Inorganic Membranes, Lillehammer, Norway, 25-29 June 2006

“Carbon Nanotube Membranes: gatekeeper functionality and enhanced fluid flow” 11th International Conference on New Diamond Science and Technology, Raleigh NC May 15-18 2006

“Transport Properties through Functionalized Aligned Carbon Nanotube Membranes” Hinds, B.J. Invited presentation at Challenges and Opportunities in the Development of Nanoelectromechanical Systems Workshop. April 8 2005 Purdue University.

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” College of Nanotechnology SUNY Albany (Sept. '07)

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Chem. Eng. Univ. Colorado (Feb. '07)

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. Mater. Sci. Eng. Univ. Florida (Feb '07)

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. Mater. Sci. Eng. Lehigh Univ. (March '07)

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. Chemistry, Penn State University, Aug 15 2006

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. Chemistry, UC San Diego, May 26 2006

“Molecular Electrodes at the exposed edge of metal-insulator-metal trilayer structures” Hewlett Packard Research Laboratory, Palo Alto CA, April 21 2006.

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. Physics, NC State University, March 20 2006

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Wright Patterson AFB, Division of Materials Research, March 1 2006

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. Chemical Engineering, University of Louisville, Feb 3 2006

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. of Chemistry, University of Southern Illinois, Oct 14 2005

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membranes” Dept. of Chemistry Workshop, University of Florida, June 1 2005

“Functional Nanomaterials: nm-Scale Shadow Lithography, Nanowire Diameter Control, and Carbon Nanotube Based Membrane Sensors” Dept. of Electrical Eng., University of Cincinnati, May 20 2005

“Gate Keeper' Functionality for Controlled Transport through Vertically Oriented Carbon Nanotube Membranes” Department of Chemistry Seminar, Univ. of North Carolina Charlotte, April 28 2005

“Carbon Nanotube Shadow Lithography and Permeable Aligned CNT Membrane for Bio-Sensor Applications” Hinds, B.J. Oral Presentation Kentucky Nano Materials Workshop, Louisville KY September 2003

“Chemistry of the Si/SiO<sub>2</sub> Interface and Single Electron Memory from a Nano-Crystalline Si Floating Gate” Dept. of Chemistry, University of Louisville. November 2001.

“MOCVD routes to Tl<sub>2</sub>Ba<sub>2</sub>Ca<sub>n-1</sub>Cu<sub>n</sub>O<sub>4+2n</sub> Superconductor and Dielectric Insulator Thin Films” Invited paper presented at the 10th Euro-CVD Conference, Venice Italy, September 1995.

*Contributed presentations from research activities at the University of Kentucky: (presenting author underlined)*

‘Aligned Carbon Nanotube Membranes with Enhance Fluid Flow and Active Gate Keeper Selectivity’ Bruce J. Hinds *oral presentation* Advanced Membrane Technology IV, Trondheim Norway June 11 2009

‘Electro-osmosis and electrophoresis in doubled walled carbon nanotube membranes’ Karen Gerstandt, Ji Wu, Bruce J. Hinds *oral presentation* Advanced Membrane Technology IV, Trondheim Norway June 9 2009

‘Dramatic Nano-Fluidic Properties Of Carbon Nanotube Membranes’ Bruce J. Hinds *oral presentation* Electron, Ion & Photon Beams and Nanofabrication, Marco Island FL, May 25 2009

‘Metal/Insulator/Metal Thin Film Electrodes for Molecular Conduction’ Bing Hu, Pawan Tyagi and Bruce Jackson Hinds *oral presentation* Spring Mater. Res. Soc. Mtg, San Francisco CA April 14 2009

‘Electro-osmotic Flow Through Carbon Nanotube Membranes’. Ji Wu, Karen Gerstandt, Mainak Majumder and Bruce Jackson Hinds *oral presentation* Spring Mater. Res. Soc. Mtg, San Francisco CA April 14 2009

‘Aligned Carbon Nanotube Membranes with Enhance Fluid Flow and Active Gate Keeper Selectivity for Water Purification’ Mainak Majumder, Karen Gerstandt, Ji Wu and Bruce Jackson Hinds *oral presentation* Spring Mater. Res. Soc. Mtg, San Francisco CA April 14 2009

‘Aligned Carbon Nanotube Membranes as Chiral Hydrogenation Platforms’ Xin Zhan, Bruce Hinds, *oral presentation* AIChE National meeting Philadelphia PA Nov. 17-22 2008

‘Mass Transport through Carbon Nanotube Membranes In Three Different Regimes: Ionic, Liquid and Gas’ Mainak Majumder, Bruce Hinds, *oral presentation* AIChE National meeting Philadelphia PA Nov. 17-22 2008

‘Electrochemical Double Layer Behavior on Vertically Oriented Cnt Electrodes’ Mainak Majumder, Bruce Hinds, *oral presentation* AIChE National meeting Philadelphia PA Nov. 17-22 2008

“Aligned Carbon Nanotube Membranes: Transport Enhancement and Electrostatic Activity” B.J. Hinds *oral presentation* Electronic Mater. Conf. Santa Barbara June 17 2008

Gated chemical transport and enhance flow through carbon nanotube membrane” M. Majumder, B.J. Hinds, *oral presentation* Amer. Chem Soc. Nat. Meeting Sept. 13 2006

“Aligned Carbon Nanotube Membranes for Transdermal Nicotine Delivery” H. Vaddi, M. Majumder, A.L. Stinchcomb, B.J. Hinds, *oral presentation* Int. Conf. on Bioengineering and Nanotechnology Santa Barbara CA Sept. 6 2006

“Rapid Mass Transport Through Carbon Nanotube in the Ionic, Solvent and Gaseous Regimes” M. Majumder, B.J. Hinds *poster presentation* Gordon Res. Conf. ‘Membranes: Materials & Processes’ Aug 8, 2006

“Molecular Electrodes at the Vertical and Exposed Edge of Tunnel Junction ” P. Tyagi, B.J. Hinds *poster presentation* Gordon Res. Conf. ‘Nanostructure Fabrication’ July 19, 2006.

“Gated Chemical Transport and Enhanced Flow through Carbon Nanotube Membranes” M. Majumder, B.J. Hinds, *poster presentation* Gordon Res. Conf. ‘Nanostructure Fabrication’ July 18, 2006.

“Scalable Molecular Electrodes at the Patterned Edge of a Metal/Insulator/Metal Junction” *oral presentation* P. Tyagi, D. Li, S.M. Holmes, B.J. Hinds *oral presentation* IEEE nano conference, Cincinnati OH, June 30 2006.

“Selective Growth of Zinc Oxide Nanowires Grown from Thin Film Multilayer Structure for Shadow Lithography” B. Hu, P. Tyagi, B.J. Hinds, *oral presentation* Electronic Materials Conf., Penn State, June 28 2006.

“Fabrication of Stable Molecular Electrode Using Patterned Edge of a Metal/Insulator/Metal Junction” P. Tyagi, B.J. Hinds *oral presentation* Electronic Materials Conf. July 19, 2006.

“Gated Chemical Transport and Enhance Flow through Carbon Nanotube Membranes” B. J. Hinds, M. Majumder and N. Chopra; *oral presentation* Mat. Res. Soc. Spring Meeting April 21, 2006.

“Etched Edge of Metal/Insulator/Metal Pattern for Molecular Scale Contacts” B. J. Hinds, P. Tyagi, S. M. Holmes *oral presentation* Mat. Res. Soc. Spring Meeting April 21, 2006.

“Selective Growth of Zinc Oxide Nanowires Grown from Thin Film Multilayer Structure for Shadow Lithography” Bruce Hinds, Nitin Chopra, Bing Hu *oral presentation* AIChE National Meeting, Oct31-Nov. 3 2006

“Controlled Transdermal Nicotine Delivery with Aligned Carbon Nanotube Membrane” Mainak Majumder, Nitin Chopra, Audra Stinchcomb, Bruce Hinds *oral presentation* AIChE National Meeting, Oct31-Nov. 3 2006

“Nanowire Diameter Control from Film Thickness at Cleaved Edges of Thin Film Multilayer Patterns” Bruce Hinds, Nitin Chopra, Bing Hu *oral presentation* AIChE National Meeting, Oct31-Nov. 3 2006

“Pressure Driven Flow and Possible Hydrogen Bond Ordering of Liquids inside Carbon Nanotubes” Mainak Majumder, N.Chopra and B.J. Hinds *oral presentation* AIChE National Meeting, Oct31-Nov. 3 2006

“Gated Chemical Transport through Vertically Aligned Carbon Nanotube Membranes” Mainak Majumder, Nitin Chopra, Bruce Hinds, *oral presentation* AIChE National Meeting, Oct31-Nov. 3 2006

“Etched Edges of Thin Film Multilayers for Molecular Scale Contacts: Mechanically Induced Instabilities” Pawan Tyagi, Bruce J. Hinds *Poster presentation* Organic Electronics Workshop, Newport RI, July 2005

“Ionic Transport Through Aligned Carbon Nanotube Membranes Functionalized at Core Entrances” Mainak Majumder, Nitin Chopra, Bruce Hinds *Oral presentation* North American Membrane Society Providence RI June 2005

“Chemical Sensing Based on Reversible Desthiobiotin Gated Ionic Transport through Aligned Carbon Nanotube Membranes” Bruce J. Hinds; Pramod Nednoor; Nitin Chopra; Leonidas Bachas *Oral presentation*, Electronic Materials Conference, Santa Barbara, June 2005

“Selective Growth, Diameter Control, and Mechanistic Study of Copper Oxide Nanowires Grown from Exposed Edge of Al<sub>2</sub>O<sub>3</sub>/Cu/Al<sub>2</sub>O<sub>3</sub> Thin Film Multilayer Structure” Nitin Chopra; Bing Hu; Bruce J. Hinds *Oral presentation*, Electronic Materials Conference, Santa Barbara, June 2005

“Bi-Functional Carbon Nanotubes by Sidewall Protection Using Aligned Carbon Nanotube Membranes” Bruce J. Hinds; Nitin Chopra; Bing Hu *Oral presentation*, Electronic Materials Conference, Santa Barbara, June 2005

“Mechanical Stress Induced Instabilities in Tunnel Magneto Resistance Devices” Pawan Tyagi; Bruce J. Hinds *Oral presentation*, Electronic Materials Conference, Santa Barbara, June 2005

“Selective End Functionalization of Carbon Nanotubes by Sidewall Protection in Aligned Membrane Structures” N Chopra, M. Majumder, B.J. Hinds *Oral presentation*, Material Research Society, Boston, December 2004

“Selective Growth, Diameter Control, and Mechanistic Study of Copper Oxide Nanowires Grown from Exposed Edge of Al<sub>2</sub>O<sub>3</sub>/Cu/Al<sub>2</sub>O<sub>3</sub> Thin Film Multilayer Structure “ N Chopra, B.J. Hinds *Poster presentation*, Material Research Society, Boston, December 2004

“Transport Properties through Functionalized Aligned Carbon Nanotube Membranes” M. Majumder, N Chopra, B.J. Hinds *Poster presentation*, Material Research Society, Boston, December 2004

“Controlled Transdermal Nicotine Delivery With Octadecyl Amine Carbon-Nanotube Polystyrene Membranes” H. K. Vaddi, M. Majumder, A. L. Stinchcomb,\* Bruce J. Hinds\*, *Poster Presentation*, American Association of Pharmaceutical Science, Nation Meeting Oct. 2004.

“Transport Studies through Tip-Functionalized Aligned Carbon Nanotube Membranes” M. Majumder, N. Chopra, B.J. Hinds *Poster presentation*, International Workshop on Nanomaterials, Lexington KY Sept. 2004 (**poster award**)

“Reversible Biochemical Switching of Ionic Current through Aligned Carbon Nanotube Membranes” Nednoor, P.; Chopra, N.; Gavalas, V.; Bachas, L.G.\*; Hinds, B.J.\* *Poster presentation*, International Workshop on Nanomaterials, Lexington KY Sept. 2004

“Suspended Carbon Nanotube Shadow Lithography: Experimental Quantification of Line-of-Site Shadow Widths” N. Chopra, W. Xu, L. Delong, B.J. Hind, *Poster presentation*, International Workshop on Nanomaterials, Lexington KY Sept. 2004

“Bi-functional Carbon Nanotubes from Sidewall Protection in Aligned Membrane Composite” N. Chopra, M. Majumder, B.J. Hinds, *Poster presentation* International Workshop on Nanomaterials, Lexington KY Sept. 2004 (**poster award**)

“Perpendicularly aligned carbon nanotubes across polymer film for novel membrane structure”  
Hinds, B.J. *Poster Presentation*, Gordon Research Conference on membranes Aug. 2004

“Perpendicularly aligned carbon nanotubes across polymer film for novel membrane structure”  
Hinds, B.J.\*; Chopra, N.; Andrews, R.; Gavalas, V.; Bachas L. *Oral Presentation*, Material Research Society, Boston, December 2003.

“Suspended Carbon nanotubes shadow lithography: incident evaporation angle dependence”  
Chopra, N.; Xu, W; De Long, L.E.; Hinds, B.J.\* *Poster presentation*, Material Research Society, Boston, December 2003

“Perpendicularly aligned carbon nanotubes across polymer film for novel membrane structure”  
Nitin Chopra, Padmaker Kichambare, Rodney Andrews, Bruce Hinds,\* *Poster Presentation*, KY Workshop on Nanomaterials, Louisville KY Sept. 2003 (**poster award**)

“Simple use of SiO<sub>2</sub> film thickness for the control of carbon nano-tube diameter during ferrocene catalyzed CVD growth” Nitin Chopra, Bruce Hinds, Padmaker Kichambare, Rodney Andrews, *Poster Presentation*, Material Research Society, Boston, November 2002

**Contributed presentations from research activities outside of the University of Kentucky:**

“Charge Storage Mechanism in Nano-Crystalline Si Based Single-Electron Memories” Bruce J. Hinds, Takayuki Yamanaka, and Shunri Oda. *Oral presentation*, Material Research Society, Boston, November 2000,

“Nano-Crystalline Si as Floating Gate Node for Single Electron Memory Devices” *Presentation with Poster* at Quantum Dot Symposium, Sapporo Japan, September 2000.

“Lifetime Analysis of Single Electron Memory from Nano-crystalline Si Dots Floating-Gate over Nano-scale Channel Transistor” *Oral presentation*, Japanese Applied Physics Society Meeting, Sapporo Japan, September 2000.

“Single Electron Memory Utilizing Nano-Crystalline Si over Short-Channel Silicon-on-Insulator Transistors “ *Oral presentation*, Device Research Conference, Denver CO, June 2000.

“Lifetime Measurements of Electrons Stored in Nano-Crystalline Si Single Electron Memory Devices” *Oral presentation* at Silicon Nano-Crystalline Workshop, Honolulu HI, June 2000.

“Single Electron Memory from Nano-crystalline Si dots Formed by the Disproportionation Reaction of Silicon Suboxide” *Oral presentation* at Japanese Applied Physics Society Meeting, Tokyo, March 2000.

“Two-Gate Transistor for the Study of Si/SiO<sub>2</sub> Interface in SOI Nano-Channel and Nanocrystalline Si Memory Device” *Oral presentation*, International Symposium on Surface Science for Micro-and Nano-Device Fabrication, Tokyo, November 1999.

“Investigation of Postoxidation Thermal Treatments of Si/SiO<sub>2</sub> in Relationship to the Kinetics of Amorphous Si Suboxide Decomposition” *Oral presentation* at International Conference on Amorphous and Microcrystalline Semiconductors, Salt Lake City UT, August 1998.

“Study of SiO<sub>x</sub> Decomposition Kinetics and Formation of Si Nanocrystals in a SiO<sub>2</sub> Matrix” *Oral presentation*, International Conference on Amorphous and Microcrystalline Semiconductors, Budapest Hungary, August 1997.

“Low pH Chemical Etch Route for Smooth H-Terminated Si(100) and Study of Subsequent Chemical Stability” *Oral presentation*, Materials Research Society Spring Meeting, San Francisco CA, March 1997.

“Preparation and Characterization of Silicon Nanocrystals in a SiO<sub>2</sub> Matrix and Study of Suboxide Stability” *Oral presentation*, Materials Research Society Fall Meeting, Boston MA, November 1996.

“Selective Oxidation and Low pH Chemical Etching Route to Smooth Si(100) H-terminated Surfaces” *Oral presentation*, 43rd American Vacuum Society Meeting, Philadelphia PA, October 1996.

“Metal-Organic Chemical Vapor Deposition Route to Epitaxial TBCCO Thin Films” *Oral presentation* at Tl-oxide Superconductor Workshop, Breckenridge CO, June 1994.

“Metal-organic Chemical Vapor Deposition of Epitaxial Tl<sub>2</sub>Ba<sub>2</sub>Ca<sub>2</sub>Cu<sub>3</sub>O<sub>10</sub> Thin Films” *Oral presented* at Materials Research Society Fall Meeting, Boston MA, November 1993.

**Graduate Student Advising**

Nitin Chopra MSE Ph.D. Aug 2005. 'Controlled carbon nanotube growth for high-throughput sub-nanometer lithography process'. (**Assist Professor U. AL Tuscaloosa**)

Mainak Majumder MSE Ph.D. September 2007 'Chemical modification and transport characterization of carbon nanotube membranes' (Post-doc Rice University Chem E, **Assist Professor/Lecturer Monash University, Australia**)

Pawan Tyagi MSE Ph.D. April 2008 'Characterization of electron spin transport through extended pi-bond coordination compounds systems' (Post-doc John Hopkins Chem E)

Bryan Gall MSE M.S. Aug 2005 'Angstrom level control of Au growth on atomically flat substrates for molecular electronics' (Intel, Pheonix Az)

Dinesh Kalyanasudaram MSE M.S. May 2007 'Multilayer magnetic thin film stuctures for spin-electronic devices' (Seagate, Minneapolis MN)

**Current students**

Bing Hu MSE Ph.D. **Expected** Apr. 2011 'Controlled growth nanowires for molecular electronics'

Xin Zang CHEM Ph.D. **Expected** May. 2011 'Chiral catalysis and separation on aligned CNT membrane'

Xin Su MSE MSE Ph.D. **Expected** Sept. 2011 'Electrochemical transformations and separations with aligned CNT membrane'

Karen Gerstand MSE Ph.D. **Expected** Dec. 2011 'Ion exclusion and forward osmotic power generation from CNT membranes'

Jingyuan Yao MSE Ph.D. **Expected** Aug. 2012 'Multilayer membrane structures for sequential catalysis and DNA sequencing'

Zhi-Qiang Chen MSE Ph.D. **Expected** Dec. 2014 'Chiral separations with CNT membranes'

Johnathan Wagner BioChem Ph.D **Expected** Aug. 2012 (biochemistry, IGERT co-advised student) 'Enzyme encapsulation and protection for therapeutic use'

**Post-doctoral**

Jacob Goldsmith '10-present (U Mich. PD

Ji Wu June '07 – present (Faculty position, Univ. Southern GA)

Jinghua Sun Sept '08 – '11 (UoL staff)

Jing Chen Jan-Feb '09 (UoL Med Center)

Karin Keis, Nov. '06 – June '07 (Seattle)



**Undergraduate Research Experiences (summer or semester)**

Zach Johnson (10), Daniel Bacon-Brown ('10), Patrick Hobitzel ('09), Joseph Alexander ('07), Corey Meadows ('06), Jeggan Cole\* ('06), J.T. Zellers ('05), Wendy Satterwhite('05), Tochukwu George \*('02, '03), Anya Jaromczyk ('03), Jim McCarthy ('02), Charles Bynaker ('02),

**High School research experience:** Mia Williams\* '05 (Dunbar), Orsolya Hegyi '10 (Dunbar)

\* minority students

**Course summaries:**

**EGR101** (Engineering Professions) is an introductory classes designed to help expose students to various disciplines of study available at UKY. For EGR101 my responsibility is to present one lecture of an introduction to Materials Science and Engineering and laboratory experience.

**MSE 101** (Materials Engineering Professions) is designed to introduce freshmen engineering majors to the field of Materials Engineering. Fundamental concepts of atomic structure, the fact that defects dictate the strength of materials and quantitative measures of stress-strain are introduced. Professional ethics is taught in the forms of examples of plagiarism, engineering case studies, and business dilemmas.

**MSE 301** (Materials Properties) is the second semester course of a year long introduction to Materials Science and Engineering. More advanced concepts of mechanics, defects, and processing are developed. Particular weaknesses in past student performance in phase diagrams and crystallography are strongly reinforced.

**MSE402G** (Electronic Materials and Processing, with lab, 4 units) is designed to give Junior/Senior undergraduates an in depth knowledge of electronic materials. This is one of the key courses to provide working knowledge in the 4 primary areas of metallurgy, polymers, ceramics, and electronic materials. The course begins with solid state physics, progresses to electronic device (transistor, laser etc.) design and operation, and ends with processing fundamentals. A particular departure from previous approaches has been to make this class content accessible to non-materials majors. During the spring semester half the class attendance was Chemistry graduate students with electronics related research projects. This class is now able to help any undergraduate engineering student with an interest in electronic materials/or processing. It is now a recommended elective for the Chemical Engineering program due to the many career opportunities in the area. A new 1-unit electronics fabrication lab has been developed to give undergraduate and graduate students hands on experience. This lab addition (as well as in 401G and 402G) was an important part of our response to ABET cited weaknesses in laboratory experience in the undergraduate curriculum. [www.engr.uky.edu/bjhinds/402g/](http://www.engr.uky.edu/bjhinds/402g/)

**MSE585** (Materials Characterization with lab, 4 units) is designed for Senior undergraduates and 1<sup>st</sup> year graduate students to learn the most powerful materials characterization techniques: x-ray diffraction, electron microscopy, and surface analysis. This is particularly critical for current research efforts in the nano-scale manipulation of matter with an emphasis on surface functionalization. In recognition of this, the course has recently been added as a mandatory requirement of the materials program curriculum. It is also a recommended elective of the Chemical Eng. program. Also this course is a key part of the proposed NSF 'Nano-Scale Engineering Education for Undergraduates' certificate program at UK, since characterization of nano-scale systems requires these tools. This course was also a critical part of our response to ABET cited weaknesses in laboratory experience in the undergraduate curriculum. Laboratory experiments had to be redesigned for a lower level of TA support and most efficient use of the TEM facility. This course was taught in conjunction with Univ. of Louisville Chem. Eng. Dept through iTV and a trip to use our TEM facility.

**MSE599** (Micro/Nanofabrication Laboratory) is a hands on lab for electronic and nanofabrication designed for Senior undergraduates and graduate students. It covers the principles and use of evaporation, sputtering, chemical vapor deposition, photolithography, reactive ion etching and thin film characterization techniques. It is a 1 unit course with alternating lecture and lab weeks. This course strongly coincides with the lab section of MSE402G.

**MSE632** (Adv. Materials: nanotechnology) is a course that focuses on the learning of topics related to the synthesis and properties of nano-scale materials. Synthetic approaches will be related to fundamental surface science, nucleation and growth mechanism and thermodynamics. Chemical activity, electronic and mechanical properties of nanomaterial systems will be studied. Specific materials systems that result in nano-structured materials as well as a variety of nano-fabrication techniques are surveyed and analyzed. Another critical goal of the course is to demonstrate the process of in-depth learning of a current research topic from the relatively shallow introductory text commonly found in emerging topic areas. This is accomplished utilizing literature sources from numerous in-class activities and analysis projects.

**MSE632** (Adv. Materials: Structure of Materials) is a course that focuses on Solid State Physics (Kittel's common text). The emphasis is on crystal structures, nature of bonding, phonons, wavefunction solutions and interaction with periodic boundaries, use of band diagrams, conductance and optical processes, and surface/interface characterization.

**Professional Activities:****Current professional society memberships**

Materials Research Society, American Chemical Society, AIChE

**Proposal and paper reviews**

NSF panel review CTS, ECS, DMR

NSF proposal mail review CTS

NIH panel review BMBI study section.

Reviewer *Nature Materials*

Reviewer *Nature Nanotechnology*

Reviewer *Science*

Reviewer *Adv. Mater*

Reviewer *J. Amer. Chem. Soc.*

Reviewer *J. Mater. Chem*

Reviewer *Chem. Mater*

Reviewer *Carbon*

Reviewer *J. Phys. Chem. B*

Reviewer *J. Membr. Sci.*

Reviewer *Appl. Phys. Lett.*

Reviewer *Nanotechnology*

Reviewer *J. Vac. Sci. Tech. A*

Reviewer *J. Thin Solid Films*

**Meetings and workshop organization.**

Elected Vice Chair, Gordon Conference on 'Membranes: Materials & Processes 2012'

Discussion Leader, 'Super-Permeability Membranes' Gordon Conference on 'Membranes: Materials & Processes 2010

Session Chair 'Oxide Thin Films' TMS Electronic Materials Conference 2010

Program Chair 'Microfluidics' International Conf. on Electron, Ion, and Photon Beam Technology and Nanofabrication 2010

'Workshop: Emerging Membrane Materials and Manufacturing methods' North American Membrane Society, July 18, 2010 (highest paid attendance of offered workshops)

'Aligned Carbon nanotubes: flow enhancement and gatekeeper activity' European Membrane Society Meeting, Mount Pellier Fr. Sept. 1-10, 2009 (keynote talk, emerging membrane materials workshop, young investigator workshop)

'Workshop: Emerging Membrane Materials and Manufacturing methods' Int. Congress on Membranes, Honolulu HI, July 13-18 2008 (highest paid attendance of offered workshops)

Presiding session chair 'Advanced Membranes for Energy and Environmental Applications' ACS Fall National meeting 2006

Session chair 'Hybrid Materials for Membranes' 9th International Conference on Inorganic Membranes 2006

IEEE nano 2006 program committee

Vice-chair 'Session 08e13. Advances in Nanolithography' AIChE National Meeting 2005

Vice-chair 'Session 03019. Nano-particle based devices' AIChE National Meeting 2005

## **University and Public Service**

### **University committee activities**

Co-Director NSF-IGERT on Engineered Bioactive Interfaces and Devices  
Assisting director for Center for Nanoscale Science and Engineering (CeNSE)  
fabrication facility.  
Joint appointment with the Department of Chemistry.  
Faculty co-advisor Materials Research Society Student Chapter  
Member CME chair faculty search committees.  
Member of Materials Program graduate student committee.  
Member CME space and safety committee.

### **Student recruitment**

Mentored 11 undergraduates for summer research. .  
Member, E-day continuing committee for Materials Program, annual participant

### **Short courses, extension activities**

'Workshop: Emerging Membrane Materials and Manufacturing methods' North American Membrane Society, July 18, 2010 (highest paid attendance of offered workshops)  
'Aligned Carbon nanotubes: flow enhancement and gatekeeper activity' European Membrane Society Meeting, Mount Pellier Fr. Sept. 1-10, 2009 (keynote talk, emerging membrane materials workshop, young investigator workshop)  
'Workshop: Emerging Membrane Materials and Manufacturing methods' Int. Congress on Membranes, Honolulu HI, July 13-18 2008 (highest paid attendance of offered workshops)  
Microfabrication laboratory Shortcourse work shop for minority program 2008 (CeNSE)  
Science Fair Judge, semi finals State Science Fair, Kentucky Academy of Sciences 2008; Science Fair Judge Dixie Elementary, Lexington Kentucky, 2007;  
Helped team teach (one 2hr lecture) a short course on for local chapter of American Society of Metallurgy (ASM) 2002,2003, and 2004 and will continue in 2005.  
Helped team teach (Lecture on 'Molecular Electronics and Nano-fabrication') for REU program's nano-technology short course.  
Helped with Fundamentals of Engineering (FE). Exam study session for Chemistry section.  
Science fair consultant Julius Marks elementary school, Oct. 2004