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Assistant Professor
University of Michigan, Ann Arbor, MI

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EDUCATION

Massachusetts Institute of Technology Cambridge, MA
Ph.D., Mechanical Engineering (GPA 5.0/5.0) Feb. 2002 – Aug. 2006
Hertz Fellow, National Science Foundation Fellow, MIT Martin Fellow
Thesis: Chemical, Mechanical, and Thermal Control of Substrate-Bound Carbon Nanotube Growth
Advisor: Prof. Alexander Slocum

Massachusetts Institute of Technology Cambridge, MA
S.M., Mechanical Engineering (GPA 5.0/5.0) Sept. 2000 – Jan. 2002
Thesis: Design and Analysis of Kinematic Couplings for Modular Machine and Instrument Structures
Advisor: Prof. Alexander Slocum

University of Michigan Ann Arbor, MI
B.S.E., Mechanical Engineering, *Summa Cum Laude* (GPA 4.0/4.0) Sept. 1997 – April 2000
Distinguished Undergraduate Achievement Award; Robert M. Caddell Award in Manufacturing

EMPLOYMENT

University of Michigan (Ann Arbor, MI) Sept. 2007 – Present
Assistant Professor, Department of Mechanical Engineering Sept. 2007 – Present
Assistant Professor (courtesy appointment), School of Art and Design April 2009 – Present
Faculty Member, Applied Physics Program Sept. 2010 – Present
Faculty Member, Microfluidics in Biomedical Sciences Training Program (MBSTP) Sept. 2010 – Present
Faculty Member, Design Science Ph.D. Program May 2011 – Present
Faculty Affiliate, Michigan Memorial Phoenix Energy Institute (MMPEI) Sept. 2008 – Present
Absolute Nano (Ann Arbor, MI) Aug. 2007 – Present
Co-Founder and Chief Scientist

Owlstone Nanotech (Cambridge, MA and Cambridge, UK) Sept. 2006 – Aug. 2007
Senior Project Engineer

Massachusetts Institute of Technology (Cambridge, MA) Sept. 2006 – July 2007
Post-Doctoral Associate in Mechanical Engineering, Aeronautics/Astronautics, and Materials Science

ArKion Systems (New Bedford, MA) Sept. 2000 – May 2004
Engineer and System Architect

General Motors Corporation (Warren, MI and Troy, MI)
Technical Project Leader, Advanced Development Group, OnStar May 2001 – Aug. 2001
Associate Design-Responsible Engineer, Body Structures Engineering May 2000 – Aug. 2000
Summer Intern, Body Structures Product Engineering May 1999 – Aug. 1999
Summer Intern, NAO Manufacturing Body Closures Center May 1998 – Aug. 1998

AWARDS (since beginning of graduate school)

Young Investigator Award, Air Force Office of Scientific Research 2011
University of Michigan Robert M. Caddell Award for Excellence in Manufacturing Research 2011
Frontiers of Engineering Symposium Attendee, National Academy of Engineering 2010
University of Michigan Mechanical Engineering Outstanding Faculty Achievement Award 2010
SME Outstanding Young Manufacturing Engineer Award 2010
R&D100 Award (Spin-Grower Automated Layer-by-Layer Assembly System) 2009
ASME Pi Tau Sigma Gold Medal (outstanding achievement within 10 years of baccalaureate) 2009

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| Holcim Next Generation Award for Sustainable Construction (with Neri Oxman) | 2008 |
| R&D100 Award (SabreTube Desktop Thermal Processing System) | 2008 |
| Young Faculty Award, Defense Advanced Research Projects Agency | 2008 |
| Finalist, MIT Clean Energy Entrepreneurship Prize | 2008 |
| MIT Senturia Prize for Best Doctoral Thesis in Micro/Nano-technology | 2006 |
| Fannie and John Hertz Foundation Graduate Fellowship | 2002–2006 |
| MIT Deshpande Center Ignition Grant (with Alex Slocum) | 2004–2006 |
| Best Poster Presentation, Nanotechnology Session, MIT MTL Annual Research Conference | 2006 |
| European Society of Precision Engineering Heidenhain Scholarship | 2005 |
| American Society of Precision Engineering R.V. Jones Memorial Scholarship | 2002 |
| National Science Foundation Graduate Research Fellowship | 2000–2002 |
| Second Place, IEEE Java Programming Contest, Boston Chapter | 2001 |
| American Society of Mechanical Engineers (ASME) Trust Scholarships | 2000, 2001 |
| MIT Martin Fellowship for Graduate Study | 2000 |

PAPERS IN REFEREED JOURNALS

From independent research group and related collaborations (began September 2007)

65. M. Bedewy, E.R. Meshot, M. Reinker, A.J. Hart. Population growth dynamics of carbon nanotubes. *ACS Nano* (in press), 2011.
64. S. Saha, D. Copic, S. Bhaskar, N. Clay, A. Donini, A.J. Hart, J. Lahann. Chemically controlled bending of compositionally anisotropic microcylinders. *Angewandte Chemie* (in press), 2011.
63. E.R. Meshot, K. Patel, S. Tawfick, K.A. Juggernaut, M. Bedewy, E.A. Verploegen, M. De Volder, A.J. Hart. Photoconductive hybrid films made by rapid, directional crystallization of C₆₀ on aligned carbon nanotubes. *Advanced Functional Materials* (in press), 2011.
62. D. Copic, S. Park, S. Tawfick, M. De Volder, A.J. Hart. Fabrication, densification, and replica molding of 3D carbon nanotube microstructures. *Journal of Visualized Experiments* (accepted), 2011.
61. M. De Volder, S. Tawfick, D. Copic, A.J. Hart. Hydrogel-driven carbon nanotube microtransducers. *Soft Matter* 7:9844-9847, 2011, <http://dx.doi.org/10.1039/C1SM06215H>.
60. M. De Volder, S. Tawfick, S. Park, A.J. Hart. Corrugated carbon nanotube microstructures with geometrically tunable compliance. *ACS Nano* 5(9):7310-7317, 2011, <http://dx.doi.org/10.1021/nn202156q>. Cover article.
59. M. De Volder, R. Vansweevel, P. Wagner, D. Reynaerts, C. Van Hoof, A.J. Hart. Hierarchical carbon nanowire microarchitectures made by plasma-assisted pyrolysis of photoresist. *ACS Nano* 5(8):6593-6600, 2011, <http://dx.doi.org/10.1021/nn201976d>.
58. R. Guzman de Villoria, A.J. Hart, B.L. Wardle. Continuous production of vertically aligned carbon nanotubes on 2D and 3D substrates. *ACS Nano* 5(6):4850-4857, 2011, <http://dx.doi.org/10.1021/nn2008645>.
57. S. Tawfick, M. De Volder, A.J. Hart. Structurally programmed folding of vertical carbon nanotube assemblies. *Langmuir* 27(10):6389-6394, 2011, <http://dx.doi.org/10.1021/la200635g>.
56. E.A. Verploegen, A.J. Hart, M. De Volder, S. Tawfick, K.K. Chia, R.E. Cohen. Non-destructive characterization of structural hierarchy within carbon nanotube assemblies. *Journal of Applied Physics* 109:094316, 2011, <http://dx.doi.org/10.1063/1.3584759>.
55. D. Copic, S.J. Park, S. Tawfick, M. De Volder, A.J. Hart. Fabrication of high-aspect-ratio polymer microstructures and hierarchical textures using carbon nanotube composite master molds. *Lab on a Chip* 11(10):1831-1837, 2011, <http://dx.doi.org/10.1039/c0lc00724b>.
54. M. De Volder, S. Park, S. Tawfick, A.J. Hart. Fabrication and electrical integration of robust carbon nanotube using self-directed elastocapillary densification. *Journal of Micromechanics and Microengineering* 21:045033, 2011, <http://dx.doi.org/10.1088/0960-1317/21/4/045033>.

53. J. Li, S. Srivastava, J.G. Ok, M. Bedewy, Y. Zhang, N.A. Kotov, A.J. Hart. Multidirectional hierarchical nanocomposites made by carbon nanotube growth within LBL-assembled films. *Chemistry of Materials* 23:1023-1031, 2011, <http://dx.doi.org/10.1021/cm1030443>.
52. G.D. Nessim, M. Seita, D.L. Plata, K.P. O'Brien, A.J. Hart, E.R. Meshot, C.M. Reddy, P.M. Gschwend, C.V. Thompson. Precursor gas chemistry determines the crystallinity of carbon nanotubes synthesized at low temperature. *Carbon* 49(3):804-810, 2011, <http://dx.doi.org/10.1016/j.carbon.2010.10.018>.
51. H.W. Baac, J.G. Ok, H.J. Park, T. Ling, S.L. Chen, A.J. Hart, L.J. Guo. Carbon nanotube composite optoacoustic transmitters for strong and high frequency ultrasound generation. *Applied Physics Letters* 97:234104, 2010, <http://dx.doi.org/10.1063/1.3522833>.
50. D.L. Plata*, E.R. Meshot* (*equal contribution), C.M. Reddy, A.J. Hart, P.M. Gschwend. Multiple alkynes react with ethylene to enhance carbon nanotube synthesis, suggesting a polymerization-like formation mechanism. *ACS Nano* 4(10):7185-7192, 2010, <http://dx.doi.org/10.1021/nn101842g>.
49. Z. Zhao, S. Tawfick, S.J. Park, M. De Volder, A.J. Hart, W. Lu. Bending of nanoscale filament assemblies by elastocapillary densification. *Physical Review E* 82:041605, 2010, <http://dx.doi.org/10.1103/PhysRevE.82.041605>.
48. M. De Volder*, S. Tawfick* (equal contribution), S. Park, D. Copic, Z. Zhao, W. Lu, A.J. Hart. Diverse 3D microarchitectures made by capillary forming of carbon nanotubes (cover article). *Advanced Materials* 22:4384-4389, 2010, <http://dx.doi.org/10.1002/adma.201001893>.
47. F.A. Hill, T.F. Havel, A.J. Hart, C. Livermore. Characterizing the failure processes that limit the storage of energy in carbon nanotube springs under tension. *Journal of Micromechanics and Microengineering* 20:104012, 2010, <http://dx.doi.org/10.1088/0960-1317/20/10/104012>.
46. J.G. Ok, S. Tawfick, K.A. Juggernaut, K. Sun, Y. Zhang, A.J. Hart. Electrically-addressable hybrid architectures of zinc oxide nanowires grown on aligned carbon nanotubes (inside cover feature). *Advanced Functional Materials* 20:2470-2480, 2010, <http://dx.doi.org/10.1002/adfm.201000249>.
45. E.R. Meshot, M. Bedewy, K.M. Lyons, A.R. Woll, K.A. Juggernaut, S. Tawfick, A.J. Hart. Measuring the lengthening kinetics of vertically aligned nanostructures by spatiotemporal correlation of height and orientation. *Nanoscale* 2:896-900, 2010, <http://dx.doi.org/10.1039/b9nr00343f>.
44. Y. Zhang, J. Gregoire, R.B. Van Dover, A.J. Hart. Ethanol-promoted growth of few-walled vertically aligned carbon nanotubes. *Journal of Physical Chemistry C* 114(14):6389-6395, 2010, <http://dx.doi.org/10.1021/jp100358j>.
43. S. Tawfick, X. Deng, A.J. Hart, J. Lahann. Nanocomposite microstructures with tunable mechanical and chemical properties. *Physical Chemistry Chemical Physics* 12:4446-4451, 2010, <http://dx.doi.org/10.1039/c000304m>.
42. M. De Volder, D.O. Vidaud, E.R. Meshot, S. Tawfick, A.J. Hart. Self-similar organization of arrays of individual carbon nanotubes and carbon nanotube micropillars. *Microelectronic Engineering* 87(5-8):1233-1238, 2010, <http://dx.doi.org/10.1016/j.mee.2009.11.139>.
41. M. Bedewy, E.R. Meshot, H. Guo, E.A. Verploegen, W. Lu, A.J. Hart. Collective mechanism of evolution and self-termination of vertically aligned carbon nanotube growth. *Journal of Physical Chemistry C* 113:20576-20582, 2009, <http://pubs.acs.org/doi/abs/10.1021/jp904152v>.
40. D.L. Plata, A.J. Hart, C.M. Reddy, P.M. Gschwend. Early evaluation of potential environmental impacts of carbon nanotube synthesis by chemical vapor deposition. *Environmental Science and Technology* 43(21):8367-8373, 2009, <http://pubs.acs.org/doi/abs/10.1021/es901626p>.
39. E.R. Meshot, D.L. Plata, S. Tawfick, E. Verploegen, A.J. Hart. Engineering vertically aligned carbon nanotube growth by decoupled thermal treatment of precursor and catalyst. *ACS Nano* 3(9):2477-2486, 2009, <http://dx.doi.org/10.1021/nn900446a>.
38. S. Tawfick, K.P. O'Brien, A.J. Hart. Flexible high conductivity carbon nanotube interconnects made by rolling and printing. *Small* 5(21):2467-2473, 2009, <http://dx.doi.org/10.1002/sml.200900741>.
37. S.A. Steiner, T.F. Baumann, B.C. Bayer, M.A. Worsley, W.J. Moberlychan, E.L. Shaw, A.J. Hart, S. Hofmann, B.L. Wardle. Nanoscale zirconia as a versatile non-metallic catalyst for graphitization of

- carbon and growth of single- and multi-wall carbon nanotubes. *Journal of the American Chemical Society* 131:12144-12154, 2009, <http://dx.doi.org/10.1021/ja902913r>.
36. G.D. Nessim, M. Seita, K.P. O'Brien, R.R. Mitchell, A.J. Hart, C.V. Thompson. Low temperature synthesis of vertically aligned carbon nanotubes with ohmic contact to metallic substrates enabled by thermal decomposition of the carbon feedstock. *Nano Letters* 9(10):3398-3405, 2009.
 35. P. Podsiadlo, M. Michel, K. Critchley, S. Srivastava, M. Qin, J.W. Lee, E.A. Verploegen, A.J. Hart, Y. Qi, N.A. Kotov. Diffusional self-organization in exponential layer-by-layer with micro- and nanoscale periodicity. *Angewandte Chemie International Edition* 48(38):7073-7077, 2009, <http://dx.doi.org/10.1002/anie.200901720>.
 34. H. Cebici, R. Guzman de Villoria, A.J. Hart, B.L. Wardle. Multifunctional properties of high volume fraction aligned carbon nanotube polymer composites with controlled morphology. *Composites Science and Technology* 69:2649-2656, 2009, <http://dx.doi.org/10.1016/j.compscitech.2009.08.006>.
 33. R. Guzman de Villoria, S.L. Figueredo, A.J. Hart, S.A. Steiner, A.H. Slocum, B.L. Wardle. High-yield growth of vertically aligned carbon nanotubes on a continuously moving substrate. *Nanotechnology* 20:405611, 2009, <http://dx.doi.org/10.1088/0957-4484/20/40/405611>.
 32. F.A. Hill, T.F. Havel, A.J. Hart, C. Livermore. Storing elastic energy in carbon nanotubes. *Journal of Micromechanics and Microengineering* 19:094015, 2009, <http://dx.doi.org/10.1088/0960-1317/19/9/094015>.
 31. S. Vozar, Y.C. Poh, T. Serbowicz, M. Bachner, P. Podsiadlo, M. Qin, E. Verploegen, N.A. Kotov, A.J. Hart. Automated spin-assisted layer-by-layer assembly of nanocomposites. *Review of Scientific Instruments* 80:023903, 2009, <http://dx.doi.org/10.1063/1.3078009>.
 30. P. Podsiadlo, M. Michel, J. Lee, E. Verploegen, N.W.S. Kam, J. Lee, Y. Qi, A.J. Hart, P.T. Hammond, N.A. Kotov. Exponential growth of LBL films with incorporated inorganic sheets. *Nano Letters* 8(6):1762-1770, 2008, <http://dx.doi.org/10.1021/nl8011648>.
 29. E.R. Meshot, A.J. Hart. Abrupt self-termination of vertically-aligned carbon nanotube growth. *Applied Physics Letters* 92:113107, 2008, <http://dx.doi.org/10.1002/10.1063/1.2889497>.

From graduate and postdoctoral work

28. N. Yamamoto, A.J. Hart, B.L. Wardle, E.J. García, S.S. Wicks, H.M. Duong, A.H. Slocum. High-yield growth of aligned carbon nanotubes on ceramic fibers for multifunctional enhancement of structural composites. *Carbon* 47(3):551-560, 2009, <http://dx.doi.org/10.1016/j.carbon.2008.10.030>.
27. D. Bello, B.L. Wardle, K. Ahn, N. Yamamoto, E.J. García, A.J. Hart, M.J. Ellenbecker. Exposure to nanoscale particles and fibers during machining of advanced composites containing carbon nanotubes. *Journal of Nanoparticle Research* 11(1):231-249, 2009, <http://dx.doi.org/10.1007/s11051-008-9499-4>.
26. N. Grossiord, J. Loos, L.C. van Laake, M. Maugey, C. Zakri, C.E. Koning, A.J. Hart. High-conductivity polymer nanocomposites obtained by tailoring the characteristics of carbon nanotube fillers. *Advanced Functional Materials* 18(20):3226-3234, 2008, <http://dx.doi.org/10.1002/adfm.200800528>.
25. G.D. Nessim, A.J. Hart, J.S. Kim, D. Acquaviva, J. Oh, C.D. Morgan, M. Seita, J.S. Leib, C.V. Thompson. Tuning of vertically-aligned carbon nanotube diameter and areal density through catalyst pre-treatment. *Nano Letters* 8(11):3587-3593, 2008, <http://dx.doi.org/10.1021/nl801437c>.
24. B.L. Wardle, D.S. Saito, E.J. García, A.J. Hart, R.G. de Villoria, E.A. Verploegen. Fabrication and characterization of ultra-high volume fraction aligned carbon nanotube polymer composites. *Advanced Materials* 20(14):2710-2714, 2008, <http://dx.doi.org/10.1002/adma.200800295>.
23. E.J. García, B.L. Wardle, A.J. Hart. Joining prepreg composite interfaces with aligned carbon nanotubes. *Composites Part A* 39(6):1065-1070, 2008, <http://dx.doi.org/10.1016/j.compositesa.2008.03.011>.
22. E.J. García, B.L. Wardle, A.J. Hart, N. Yamamoto. Fabrication and multifunctional properties of a hybrid laminate with aligned carbon nanotubes grown *in situ*. *Composites Science and Technology* 68:2034-2041, 2008, <http://dx.doi.org/10.1016/j.compscitech.2008.02.028>.
21. E.J. García, A.J. Hart, B.L. Wardle. Long carbon nanotubes grown on the surface of fibers for hybrid composites. *ALAA Journal* 46(6):1405-12, 2008, <http://dx.doi.org/10.2514/1.25004>.

20. D. Bello, A.J. Hart, K. Ahn, M. Hallock, N. Yamamoto, E.J. Garcia, B.L. Wardle, M.J. Ellenbecker. Particle exposure levels during growth and subsequent handling of vertically-aligned carbon nanotube films. *Carbon* 46:974-981, 2008, <http://dx.doi.org/10.1016/j.carbon.2008.03.003>.
19. O. Yaglioglu, R. Martens, A.J. Hart, A.H. Slocum. Conductive carbon nanotube composite microprobes. *Advanced Materials* 20:357-362, 2008, <http://dx.doi.org/10.1002/adma.200700075>.
18. A.J. Hart, H.K. Taylor, A.H. Slocum. 2D and 3D growth of carbon nanotubes on substrates, from nanometre to millimetre scales. *International J. Nanomanufacturing* 1(6):701-709, 2007.
17. B.N. Wang, R.D. Bennett, E. Verploegen, A.J. Hart, R.E. Cohen. Characterizing the morphologies of mechanically-manipulated multi-wall carbon nanotube films by small-angle X-ray scattering. *J. Physical Chemistry C* 111(48):17933-17940, 2007, <http://dx.doi.org/10.1021/jp071798c>.
16. L.C. van Laake, A.J. Hart, A.H. Slocum. A suspended heated silicon platform for rapid thermal control of surface reactions with application to carbon nanotube synthesis. *Review of Scientific Instruments* 78:083901, 2007, <http://dx.doi.org/10.1063/1.2760936>.
15. E.J. García, A.J. Hart, B.L. Wardle, A.H. Slocum. Fabrication and nanocompression testing of aligned CNT/polymer nanocomposites. *Advanced Materials* 19:2151-2156, 2007, <http://dx.doi.org/10.1002/adma.200700237>.
14. B.N. Wang, R.D. Bennett, E. Verploegen, A.J. Hart, R.E. Cohen. Quantitative characterization of the morphology of multi-wall carbon nanotube films by small-angle X-ray scattering. *J. Physical Chemistry C* 111(16):5859-5865, 2007, <http://dx.doi.org/10.1021/jp068895a>.
13. A.J. Hart, L.C. van Laake, A.H. Slocum. Desktop growth of carbon nanotube monoliths with *in situ* optical imaging. *Small* 3(5):772-777, 2007, <http://dx.doi.org/10.1002/sml.200600716>.
12. E.J. García, A.J. Hart, B.L. Wardle, A.H. Slocum. Fabrication of composite microstructures by capillarity-driven wetting of aligned carbon nanotubes with polymers. *Nanotechnology* 18(16):165602, 2007, <http://dx.doi.org/10.1088/0957-4484/18/16/165602>.
11. O. Yaglioglu, A.J. Hart, R. Martens, A.H. Slocum. Method of characterizing electrical contact properties of carbon nanotube coated surfaces. *Review of Scientific Instruments* 77:095105, 2006, <http://dx.doi.org/10.1063/1.2349300>.
10. R.D. Bennett, A.J. Hart, A.C. Miller, P.T. Hammond, D.J. Irvine, R.E. Cohen. Creating patterned carbon nanotube catalysts through the microcontact printing of block copolymer micellar thin films. *Langmuir* 22:8273-8276, 2006, <http://dx.doi.org/10.1021/la061054a>.
9. R.D. Bennett, A.J. Hart, R.E. Cohen. Controlling the morphology of carbon nanotube films by varying the areal density of catalyst nanoparticles using block copolymer micellar thin films. *Advanced Materials* 18:2274-2279, 2006, <http://dx.doi.org/10.1002/adma.200600975>.
8. A.J. Hart, A.H. Slocum. Force output, control of film structure, and micro-scale shape replication by carbon nanotube growth under mechanical pressure. *Nano Letters* 6:1254-1260, 2006, <http://dx.doi.org/10.1021/nl0524041>.
7. A.J. Hart, A.H. Slocum. Rapid growth and flow-mediated nucleation of millimeter-scale aligned carbon nanotube structures from a thin-film catalyst (cover article). *J. Physical Chemistry B* 110(16):8250-8257, 2006, <http://dx.doi.org/10.1021/jp055498b>.
6. A.J. Hart, B.O. Boskovic, A.T.H. Chuang, V.B. Golovko, J. Robertson, B.F.G. Johnson, A.H. Slocum. Uniform and selective cvd growth of carbon nanotubes and nanofibers on arbitrarily microstructured silicon surfaces. *Nanotechnology* 17:1397-1403, 2006, <http://dx.doi.org/10.1088/0957-4484/17/5/039>.
5. A.J. Hart, A.H. Slocum, L. Royer. Growth of conformal single-walled carbon nanotube films from Mo/Fe/Al₂O₃ deposited by electron beam evaporation. *Carbon*, 44(2):348-359, 2006, <http://dx.doi.org/10.1016/j.carbon.2005.07.008>.
4. P.J. Willoughby, A.J. Hart, A.H. Slocum. Experimental determination of kinematic coupling repeatability in industrial and laboratory conditions. *SME J. Manufacturing Systems* 24:108-121, 2005, <http://proquest.umi.com/pqdlink?did=1075698831&Fmt=7&clientId=5482&RQT=309&VName=PQD>.

3. A.J. Hart, A.H. Slocum, J. Sutin. Segmented and shielded structures for reduction of thermal expansion-induced tilt errors. *J. Int'l. Soc. Precision Engineering and Nanotechnology*, 28:443-458, 2004, <http://dx.doi.org/10.1016/j.precisioneng.2004.01.002>.
2. A.J. Hart, A.H. Slocum, P.J. Willoughby. Kinematic coupling interchangeability. *J. Int'l. Soc. Precision Engineering and Nanotechnology*, 28:1-15, 2004, <http://dx.doi.org/10.1016/j.precisioneng.2004.01.002>.
1. A.H. Slocum, M. Basaran, R. Cortesi, A.J. Hart. Linear motion carriage with aerostatic bearings preloaded by inclined iron core linear electric motor. *J. Int'l. Soc. Precision Engineering and Nanotechnology* 27:382-394, 2003, [http://dx.doi.org/10.1016/S0141-6359\(03\)00037-0](http://dx.doi.org/10.1016/S0141-6359(03)00037-0).

PAPERS IN REFEREED CONFERENCE PROCEEDINGS

From independent research group and related collaborations (began September 2007)

31. J.D. Beroz, S. Awtar, M. Bedewy, A.J. Hart. Compliant microgripper with straight-line jaw trajectory. Submitted to ASPE Annual Meeting, Denver, CO, 2011.
30. S. Tawfick, S.J. Park, D. Copic, M. De Volder, Z. Zhao, W. Lu, A.J. Hart. Scalable manufacturing of 3D microstructures using carbon nanotube patterns. Submitted to ASME International Mechanical Engineering Congress and Exposition, Denver, CO, 2011.
29. M. De Volder, S. Tawfick, D. Copic, A.J. Hart. Hygroscopic biomimetic transducers made from CNT-hydrogel composites (accepted for oral presentation). 16th International Conference on Solid-State Sensors, Actuators, and Microsystems, Beijing, China, 2011.
28. M. De Volder, S. Tawfick, S. Park, D. Copic, A.J. Hart. Programmable transformation of vertical carbon nanotubes into 3D microstructures (accepted for oral presentation). 16th International Conference on Solid-State Sensors, Actuators, and Microsystems, Beijing, China, 2011.
27. F.A. Hill, T.F. Havel, A.J. Hart, C. Livermore. Tuning the tensile properties of carbon nanotube springs by densification. 10th International Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS), Leuven, Belgium, 2010.
26. M. De Volder, S. Tawfick, D. Reynaerts, C. Van Hoof, A.J. Hart. Temperature sensor from self-assembled carbon nanotube bridges. IEEE Sensors 2010 Conference, Waikoloa, HI, 2010, <http://dx.doi.org/10.1109/ICSENS.2010.5690868>.
25. M. Bedewy, E.R. Meshot, E.S. Polsen, S. Tawfick, A.J. Hart. Collective mechanisms limiting the indefinite growth of carbon nanotube assemblies. SAMPE Fall Technical Conference, Salt Lake City, UT, 2010.
24. J.G. Ok, K.A. Juggernaut, K. Sun, A.A. McLane, Y. Zhang, S. Tawfick, A.J. Hart. Hybrid architectures of metal oxide nanostructures grown on aligned carbon nanotubes. Annual meeting of the Microbeam Analysis Society (Microscopy & Microanalysis), Portland, OR, 2010.
23. K.A. Juggernaut, K. Sun, A.J. Hart, S. Daly. Hybrid structures of NiTi and carbon nanotubes. Annual meeting of the Microbeam Analysis Society (Microscopy & Microanalysis), Portland, OR, 2010.
22. E.S. Polsen, S. Tawfick, E.R. Meshot, A.J. Hart. Continuous manufacturing of aligned carbon nanotube films. 38th North American Manufacturing Research Conference (NAMRC38), Kingston, Ontario, 2010.
21. F.A. Hill, T.F. Havel, A.J. Hart, C. Livermore. Characterizing the failure processes that limit the storage of energy in carbon nanotube springs under tension. 9th International Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS), Washington, DC, 2009.
20. M. De Volder, D. Vidaud, S.J. Park, S. Tawfick, A.J. Hart. Fabrication of robust carbon nanotube microstructures by elastocapillary densification. 35th International Conference on Micro & Nano Engineering, Ghent, Belgium, 2009.
19. M. De Volder, S. Tawfick, A.J. Hart. Controlled growth orientation of carbon nanotube pillars by catalyst patterning in microtrenches. 15th International Conference on Solid-State Sensors, Actuators, and Microsystems, Denver, CO, 2009, <http://dx.doi.org/10.1109/SENSOR.2009.5285636>.

From graduate and postdoctoral work

18. H. Cebeci, R.G. de Villoria, B.L. Wardle, D.S. Saito, N. Yamamoto, K. Ishiguro, E.J. Garcia, A.J. Hart, Processing of advanced composites using capillarity-driven wetting of aligned carbon nanotubes. SAMPE Fall Technical Conference, Memphis, TN, 2008.
17. B.L. Wardle, D. Bello, K. Ahn, N. Yamamoto, R.G. de Villoria, M. Hallock, E.J. Garcia, A.J. Hart, Particle and fiber exposures during processing of hybrid carbon nanotube advanced composites. SAMPE Fall Technical Conference, Memphis, TN, 2008.
16. E.J. Garcia, B.L. Wardle, R.G. de Villoria, S. Wicks, K. Ishiguro, N. Yamamoto, A.J. Hart. Aligned carbon nanotube reinforcement of advanced composite ply interfaces. 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Chicago, IL, 2008.
15. D.S. Saito, B.L. Wardle, E.J. Garcia, L. Megalini. Fabrication and multifunctional properties of high volume fraction aligned carbon nanotube polymeric composites. 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Chicago, IL, 2008.
14. L. Megalini, B.L. Wardle, D.S. Saito, E.J. Garcia, A.J. Hart. DC and AC properties of aligned carbon nanotube forests and polymeric nanocomposites. 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Chicago, IL, 2008.
13. E.J. García, A.J. Hart, B.L. Wardle, A.H. Slocum. Aligned carbon nanotube reinforcement of graphite/epoxy ply interfaces. 16th International Conference on Composite Materials, Kyoto, Japan, 2007.
12. N. Yamamoto, E.J. García, A.J. Hart, B.L. Wardle, A.H. Slocum. Multifunctional characterization of aligned CNT-reinforced woven fiber composites. 16th International Conference on Composite Materials, Kyoto, Japan, 2007.
11. E.J. García, A.J. Hart, B.L. Wardle, A.H. Slocum. Aligned carbon nanotube reinforcement of ply interfaces in woven composites. 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, 2007.
10. A.J. Hart, L.C. van Laake, A.H. Slocum. Precision design of tube furnace systems for growth of carbon nanotube films. 6th International Conference of the European Society of Precision Engineering and Nanotechnology, p. 413-416, Baden, Austria, 2006.
9. O. Yaglioglu, A.J. Hart, A.H. Slocum. Electromechanical characterization of carbon nanotube contact surfaces. 6th International Conference of the European Society of Precision Engineering and Nanotechnology, p. 406-409, Baden, Austria, 2006.
8. L.C. van Laake, A.J. Hart, A.H. Slocum. Design and modeling of a suspended silicon substrate heater and its application to novel studies of carbon nanotube growth. 6th International Conference of the European Society of Precision Engineering and Nanotechnology, p. 381-384, Baden, Austria, 2006.
7. E.J. García, A.J. Hart, B.L. Wardle, A.H. Slocum. Fabrication and testing of long carbon nanotubes grown on the surface of fibers for hybrid composites. 47th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Newport, RI, 2006.
6. J. Sutin, S. Awtar, A.J. Hart, A.H. Slocum, and E. Gratton. Improving the performance of the optical microscope via modern optical and optomechanical design. Focus on Microscopy, Jena, Germany, 2005.
5. A.J. Hart, A.H. Slocum. Design and fabrication of microchannel arrays for combinatorial studies of nanomaterials growth. 5th International Conference of the European Society of Precision Engineering and Nanotechnology, p. 81-84, Montpellier, France, 2005.
4. A.H. Slocum, J. Lang, S. Awtar, A.J. Hart, K. Mukaddam*. Magnetically-preloaded wheels. in Proceedings of the 4th International Conference of the European Society of Precision Engineering and Nanotechnology, p. 368-369, Glasgow, Scotland, 2004.
3. A.H. Slocum, S. Awtar, A.J. Hart. Magnebots—A magnetic wheels-based overhead transportation concept. 2nd IFAC Conference on Mechatronic Systems, p. 833-838, Berkeley, CA, 2003.

2. A.J. Hart, A.H. Slocum. Kinematic coupling interchangeability. American Society for Precision Engineering Annual Meeting, p. 158-161, St. Louis, MO, 2002.
1. A.J. Hart, A.H. Slocum. Segmented and shielded structures for reduction of thermal expansion-induced tilt errors. American Society for Precision Engineering Annual Meeting, p. 193-198, St. Louis, MO, 2002.

ABSTRACTS IN REFEREED CONFERENCE PROCEEDINGS

From independent research group and related collaborations (began September 2007)

66. E.S. Polsen, M. Bedewy, E.R. Meshot, S. Tawfick, A.J. Hart. Continuous manufacturing of aligned carbon nanotube films. Submitted to ASME International Mechanical Engineering Congress and Exposition, Denver, CO, 2011.
65. H.W. Baac, J.G. Ok, S.L. Chen, T. Ling, A.J. Hart, L.J. Guo. Optacoustic generation of high frequency ultrasound using a carbon nanotube polymer composite film. SPIE Photonics West, San Francisco, CA, 2011.
64. E.R. Meshot, S. Tawfick, M. Bedewy, K. Patel, K.A. Juggernaut, A.J. Hart. Guided formation and interconnection of C₆₀ crystals on aligned carbon nanotube scaffolds. Materials Research Society Fall Meeting, Boston MA, 2010.
63. A.J. Schmidt, R. Murphy, S. Park, S.M. Yalisove, A.J. Hart. Machining and modification of carbon nanotube forests using ultrafast laser irradiation. Materials Research Society Fall Meeting, Boston MA, 2010.
62. E.R. Meshot, D.L. Plata, G.D. Nessim, M. Seita, Y. Zhang, C.M. Reddy, P.M. Gschwend, C.V. Thompson, A.J. Hart Control of carbon nanotube size and structure by precursor gas chemistry. Materials Research Society Fall Meeting, Boston MA, 2010.
61. M. Bedewy, M.J. Reinker, E.R. Meshot, A. Woll, E.S. Polsen, A.J. Hart. Revealing the population kinetics of carbon nanotube growth. Materials Research Society Fall Meeting, Boston MA, 2010.
60. S. Tawfick, M. De Volder, M.J. Roberts, M. Leach, J. Corey, A.J. Hart. Controlled flopping of vertical carbon nanotube gratings into multi-directional and multi-layered networks. Materials Research Society Fall Meeting, Boston MA, 2010.
59. D. Copic, S. Tawfick, S. Park, M. De Volder, A.J. Hart. Fabrication and replication of hierarchically textured polymer microstructures using carbon nanotube master molds. Materials Research Society Fall Meeting, Boston MA, 2010.
58. S. Tawfick, M. De Volder, S. Park, Z. Zhao, W. Lu, A.J. Hart. Design and fabrication of 3D carbon nanotube microarchitectures using self-directed capillary action. Materials Research Society Fall Meeting, Boston MA, 2010.
57. M.E. Merriam, M. Roberts, Y. Zhang, N.K. Dhingra, A.J. Hart, K.D. Wise. CNT-modified electrode sites for in vitro and in vivo silicon probe studies. Biomedical Engineering Society (BMES) Conference, Austin, TX, 2010.
56. S. Tawfick, X. Deng, A.J. Hart, J. Lahann. Nanocomposite microstructures with tunable mechanical and chemical properties. Annual Meeting of the American Institute of Chemical Engineers, Salt Lake City, UT, 2010.
55. S. Tawfick, M. De Volder, S.J. Park, D. Copic, A.J. Hart. Directed assembly of complex and robust carbon nanotube microarchitectures by capillary forming. Gordon Conference on Nanostructure Fabrication, Tilton, NH, 2010.
54. F.A. Hill, T.F. Havel, A.J. Hart, C. Livermore. Studying the mechanical properties of carbon nanotube fibers for energy storage applications. 11th International Conference on the Science and Application of Nanotubes, Montreal, Quebec, 2010.
53. D.L. Plata, E.R. Meshot, A.J. Hart, C.M. Reddy, P.M. Gschwend. Alkyne-assisted carbon nanotube synthesis improves growth rate, yield, and quality while reducing costs and environmental impacts. Gordon Research Conference on Environmental Science, Plymouth, NH, 2010.

52. A.J. Hart, E.R. Meshot, M. Bedewy, E.S. Polsen, S. Tawfick. Making carbon nanotube forests: from collective growth mechanics to multifunctional materials. Materials Research Society Spring Meeting, San Francisco, CA, 2010.
51. E.R. Meshot, D.L. Plata, K.M. Lyons, C.M. Reddy, P.M. Gschwend, A.J. Hart. Efficient hydrocarbon precursors for rapid and clean carbon nanotube growth. Materials Research Society Spring Meeting, San Francisco, CA, 2010.
50. J.G. Ok, S. Tawfick, K.A. Juggernaut, K. Sun, Y. Zhang, A.J. Hart. Photoelectric and piezoelectric energy conversion using hybrid architectures of zinc oxide nanowires and aligned carbon nanotubes. Materials Research Society Spring Meeting, San Francisco, CA, 2010.
49. M. Bedewy, E.R. Meshot, K.M. Lyons, A. Woll, K.A. Juggernaut, S. Tawfick, A.J. Hart. True linear kinetics of vertically aligned carbon nanotube growth revealed by spatial mapping of alignment. Materials Research Society Spring Meeting, San Francisco, CA, 2010.
48. M. De Volder, D. Vidaud, S.J. Park, S. Tawfick, A.J. Hart. Fabrication of robust carbon nanotube microstructures by elastocapillary densification. 35th International Conference on Micro & Nano Engineering, Ghent, Belgium, 2009.
47. E.R. Meshot, D.L. Plata, C.M. Reddy, P.M. Gschwend, A.J. Hart. Co-optimizing carbon nanotube synthesis: Control of diameter, structural quality, and growth kinetics along with simultaneous cost minimization. 4th NASA - Air Force Research Laboratory and Rice University Workshop on Nucleation and Growth Mechanisms of Single Wall Carbon Nanotubes, Bourne, TX, 2009.
46. E.R. Meshot, D.L. Plata, C.M. Reddy, P.M. Gschwend, A.J. Hart. Co-optimizing carbon nanotube synthesis: Control of diameter, structural quality, and growth kinetics along with simultaneous cost minimization. American Physical Society March Meeting (Session A24), Pittsburgh, PA, 2009.
45. Y. Zhang, J. Gregoire, A.J. Hart. Ethanol-promoted growth of dense vertically aligned small diameter carbon nanotubes. American Physical Society March Meeting (Session A24), Pittsburgh, PA, 2009.
44. S. Tawfick, A.J. Hart. Manufacturing thin films of densely packed horizontally aligned carbon nanotubes. American Physical Society March Meeting (Session A24), Pittsburgh, PA, 2009.
43. M. Bedewy, E.R. Meshot, Y. Zhang, H. Guo, W. Lu, A.J. Hart. Termination mechanism of carbon nanotube forest growth. American Physical Society March Meeting (Session A24), Pittsburgh, PA, 2009.
42. M. De Volder, D. Vidaud*, S. Tawfick, A.J. Hart. Self-similar mechanics of vertically aligned carbon nanotube organization. American Physical Society March Meeting (Session D24), Pittsburgh, PA, 2009.
41. J.G. Ok, A.J. Hart. Optimization of air-assisted CVD growth of vertically aligned ZnO nanowires, guided by structural analysis using X-ray scattering. American Physical Society March Meeting (Session D24), Pittsburgh, PA, 2009.
40. A.J. Hart, E. Polsen, S.M. Perkins*, E.R. Meshot, M. Bedewy, E.A. Verploegen, M. Park, B.L. Wardle, E.J. Garcia. Continuous manufacturing and materials integration of structurally-precise carbon nanotube forests. Materials Research Society Fall Meeting (Symposium JJ), Boston, MA, 2008.
39. A.J. Hart, E.A. Verploegen, E.R. Meshot, S. Han, J. Ng*. Dynamics of vertically-aligned carbon nanotube growth revealed by in situ X-ray scattering. Materials Research Society Fall Meeting (Symposium OO), Boston, MA, 2008.
38. S. Tawfick, K. O'Brien, M. Moebius, A.J. Hart, Roll-to-roll fabrication and transfer printing of dense horizontally-aligned carbon nanotube ribbons. Materials Research Society Fall Meeting (Symposium I), Boston, MA, 2008.
37. P. Podsiadlo, M. Michel, J. Lee, E. Verploegen, N.W.S. Kam, J. Lee, Y. Qi,, A.J. Hart, P.T. Hammond, N.A. Kotov, Exponential growth of LBL films with incorporated inorganic sheets, Annual Meeting of the American Institute of Chemical Engineers, Philadelphia, PA, 2008.

36. A.J. Hart, E. Verploegen, E.R. Meshot, S. Han. Elucidating the dynamics of vertically-aligned carbon nanotube growth by in situ X-ray scattering. International Winter School on the Electronic Properties of Nanomaterials, Kirchberg, Austria, 2008.

From graduate and postdoctoral work

35. G.D. Nessim, M. Seita, D. Plata, K.P. O'Brien, A.J. Hart, C.V. Thompson. Low-temperature growth of carbon nanotubes on metallic substrates for interconnect applications. Materials Research Society Fall Meeting (Symposium JJ), Boston, MA, 2008.
34. S.A. Steiner, M.S. Tsai, K. Ishiguro, R.G. de Villoria, A.J. Hart, B.L. Wardle. Growth of aligned carbon nanotubes on carbon fibers and nanotube yarns: Hierarchal fiber architectures for advanced composites. Materials Research Society Fall Meeting (Symposium JJ), Boston, MA, 2008.
33. H. Cebici, R.G. de Villoria, B.L. Wardle, A.J. Hart. Fabrication and characterization of aligned CNT polymer nanocomposites (PNCs). Materials Research Society Fall Meeting (Symposium JJ), Boston, MA, 2008.
32. R.G. de Villoria, H. Cebeci, D.S. Saito*, E.J. Garcia, A.J. Hart, H.M. Duong, N. Yamamoto, A. Schmidt, M. Park, E. A. Verploegen, D.V. Papavassiliou, S. Maruyama, B.L. Wardle. Novel platform for fabricating and testing ultra-high volume fraction aligned-CNT nanocomposites. 9th International Conference on the Science and Application of Nanotubes, Montpellier, France, 2008.
31. R.G. de Villoria, N. Yamamoto, K. Ishiguro, S. Wicks, E.J. Garcia, A.J. Hart, S. Steiner III, B.L. Wardle. Nanostitching and fuzzy fibers: Practical fabrication of hybrid nano-engineered composites with enhanced multifunctional properties using aligned CNTs. 9th International Conference on the Science and Application of Nanotubes, Montpellier, France, 2008.
30. N. Yamamoto, A.J. Hart, E.J. Garcia, S.S. Wicks, H.M. Duong, A.H. Slocum, B.L. Wardle, Multifunctional enhancement of structural composites via growth of radially aligned carbon nanotubes on ceramic fibers. 9th International Conference on the Science and Application of Nanotubes, Montpellier, France, 2008.
29. S. Wicks, N. Yamamoto, R.G. de Villoria, K. Ishiguro, E.J. Garcia, H. Cebeci, A.J. Hart, B.L. Wardle. Fabrication of nano-engineered composites reinforced with carbon nanotubes. 10th Annual Nano Science and Technology Institute Conference, Boston, MA, 2008.
28. A.J. Hart, A.H. Slocum, D.A. Lucca, L. Shao, B.N. Wang, R.D. Bennett, R.E. Cohen. Competition among limiting growth mechanisms of vertically aligned carbon nanotubes. Materials Research Society Fall Meeting (Symposium II), Boston, MA, 2007.
27. A.J. Hart, E. Verploegen, B.N. Wang, R.D. Bennett, R.E. Cohen. Quantifying structural characteristics of carbon nanotube ensembles using X-ray scattering. Materials Research Society Fall Meeting (Symposium II), Boston, MA, 2007.
26. E.J. Garcia, A.J. Hart, N. Yamamoto, B.L. Wardle, A.H. Slocum. Fiber composites reinforced by aligned carbon nanotubes, Materials Research Society Fall Meeting (Symposium II), Boston, MA, 2007.
25. G.D. Nessim, A.J. Hart, J.S. Kim, D. Acquaviva, J. Oh, C. Morgan, C.V. Thompson. Tuning of vertically aligned carbon nanotube length, number of walls, and areal density through catalyst pre-treatment. Materials Research Society Fall Meeting (Symposium II), Boston, MA, 2007.
24. G.D. Nessim, J. Oh, A.J. Hart, D. Acquaviva, C.V. Thompson. Carbon nanotube growth into periodic scaffolds on conductive substrates for interconnect applications. SRC Techcon, Austin, TX, 2007.
23. E. Verploegen, B.N. Wang, R.D. Bennett, A.J. Hart, R.E. Cohen. Quantitative morphological characterization of multi-wall carbon nanotube films by small-angle X-ray scattering, 234th American Chemical Society National Meeting, Boston, MA, 2007.
22. A.J. Hart, D. Kuhn, L.C. van Laake, A.H. Slocum. SabreTube: A flexible, low-cost desktop system for chemical vapor deposition. 8th International Conference on the Science and Application of Nanotubes, Ouro Preto, Brazil, 2007.

21. E.J. Garcia, A.J. Hart, B.L. Wardle, A.H. Slocum. Fiber composites reinforced by aligned carbon nanotubes. 8th International Conference on the Science and Application of Nanotubes, Ouro Preto, Brazil, 2007.
20. G.D. Nessim, A.J. Hart, D. Acquaviva, J. Oh, J. Kim, C.V. Thompson. Tuning the diameter and areal density of aligned carbon nanotubes by engineered pre-treatment of the catalyst film. 8th International Conference on the Science and Application of Nanotubes, Ouro Preto, Brazil, 2007.
19. B.N. Wang, E. Verploegen, R.D. Bennett, A.J. Hart, R.E. Cohen. Elucidating and mapping morphological variations in carbon nanotube films by small-angle X-ray scattering. 8th International Conference on the Science and Application of Nanotubes, Ouro Preto, Brazil, 2007.
18. N. Grossiord, J. Meuldijk, J. Loos, P. van der Schoot, O. Regev, A.J. Hart, L.C. van Laake, H.E. Miltner, B. van Mele and C.E. Koning. A latex-based concept for obtaining carbon nanotube-polymer nanocomposites. 10th Annual Nano Science and Technology Institute Conference, Santa Clara, CA, 2007.
17. L.C. van Laake, A.J. Hart, A.H. Slocum, D.A. Lucca, L. Shao, M. J. Klopstein. Growth and in situ optical characterization of aligned carbon nanotube monoliths using a desktop reactor apparatus with rapid thermal control. Materials Research Society Fall Meeting, Boston, MA, 2006.
16. R.D. Bennett, A.J. Hart, R.E. Cohen. Controlling the morphology of carbon nanotube films by varying the areal density of catalyst nanoparticles using block copolymer micellar thin films. Materials Research Society Fall Meeting, Boston, MA, 2006.
15. A.J. Hart, H.K. Taylor, A.H. Slocum. Two-dimensional and three-dimensional growth of carbon nanotubes on substrates, from nm-to mm-scales. 4th International Symposium on Nanomanufacturing, Cambridge, MA, 2006.
14. R.D. Bennett, A.J. Hart, R.E. Cohen. Controlling the morphology of carbon nanotube films by varying the areal density of catalyst nanoparticles using block copolymer micellar thin films. Annual Meeting of the American Institute of Chemical Engineers, San Francisco, CA, 2006.
13. B.O. Boskovic, A. J. Hart, A.T.H. Chuang, V. B. Golovko, B. F. G. Johnson, A. H. Slocum, J. Robertson. Carbon nanotube synthesis on arbitrary three-dimensional surfaces. Carbon 2006 International Conference, Aberdeen, Scotland, 2006.
12. O. Yaglioglu, R. Martens, A.J. Hart, A.H. Slocum. Transfer and reinforcement of carbon nanotube structures with epoxy. 7th International Conference on the Science and Application of Nanotubes, Nagano, Japan, 2006.
11. A.J. Hart, A.H. Slocum. High-precision and combinatorial studies of carbon nanotube CVD synthesis using microchannel arrays. 7th International Conference on the Science and Application of Nanotubes, p. 89, Nagano, Japan, 2006.
10. A.J. Hart, A.H. Slocum. Force output and control of carbon nanotube film structure by applying mechanical pressure during growth. 7th International Conference on the Science and Application of Nanotubes, Nagano, Japan, 2006.
9. L.C. van Laake, A.J. Hart, A.H. Slocum. A flexible, controllable, and observable platform for laboratory studies of carbon nanotube growth. 7th International Conference on the Science and Application of Nanotubes, Nagano, Japan, 2006.
8. A.J. Hart, A.H. Slocum. Carbon nanotube growth under applied pressure: Mechanical energy output and control of film structure. Meeting of the American Physical Society, Baltimore, MD, 2006.
7. A.J. Hart, A.H. Slocum. Combinatorial flow studies of carbon nanotube growth using microchannel arrays. Materials Research Society Fall Meeting (Symposium LL), Boston, MA, 2005.
6. R.D. Bennett, A.J. Hart, R.E. Cohen. Strategies for controlling the planar arrangement of micellar-templated inorganic nanoclusters and their applications in carbon nanotube synthesis. Materials Research Society Fall Meeting (Symposium O), Boston, MA, 2005.

5. A.J. Hart, A.H. Slocum. Versatility of the Fe/Al₂O₃ System for high-yield carbon nanotube growth by thermal CVD of C₂H₄. 6th International Conference on the Science and Application of Nanotubes, Göteborg, Sweden, 2005.
4. A.J. Hart, A.H. Slocum. Carbon nanotube growth studies using gas activity gradients introduced by novel sample configurations. 6th International Conference on the Science and Application of Nanotubes, Göteborg, Sweden, 2005.
3. O. Yaglioglu, A.J. Hart, A.H. Slocum. Electrical resistance and contact properties of carbon nanotube films on silicon surfaces. 6th International Conference on the Science and Application of Nanotubes, Göteborg, Sweden, 2005.
2. A.J. Hart, A.H. Slocum. Thermal CVD of CNTs from Fe/Mo catalysts: Morphology transitions mediated by gas temperature and substrate topography. 5th International Conference on the Science and Application of Nanotubes, San Luis Potosi, Mexico, 2004.
1. P.J. Willoughby, A.J. Hart, A.H. Slocum. Experimental determination of kinematic coupling repeatability in industrial and laboratory conditions. American Society for Precision Engineering Annual Meeting, Portland, OR, 2003.

INVITED TALKS

29. 5th NASA / Rice University Workshop on Nucleation and Growth Mechanisms of Single-Wall Carbon Nanotubes, “Collective Mechanisms of Carbon Nanotube Forest Growth”, April 2011.
28. University of Wisconsin, Department of Mechanical Engineering, “Carbon Nanotube Micromaterial Architectures”, March 2011.
27. National Institute of Standards and Technology, “Characterization of Carbon Nanotubes for Science and Manufacturing”, February 2011.
26. University of Maryland Institute for Systems Research, “Carbon Nanotube Micromaterial Architectures”, February 2011.
25. IMEC (Leuven, Belgium), “Carbon Nanotube Forests: Growth Mechanics and New MEMS Materials”, December 2010.
24. Air Force Research Laboratory Carbon Nanotube Workshop, “Capillary Forming of 3D Carbon Nanotube Microarchitectures”, October 2010.
23. University of Cincinnati, “3D Micromanufacturing Using Carbon Nanotubes”, October 2010
22. First International Nanotechnology Congress (Quito, Ecuador) “Opportunities and Challenges in Nanomanufacturing”, keynote lecture, June 2010.
21. TEDxUofM conference, “Nanobliss: Telling Big Stories Using Small Things”, April 2010.
20. Materials Research Society Spring Meeting “Making Carbon Nanotube Forests: From Collective Growth Mechanics to Complex Materials”, San Francisco, CA, April 2010.
19. Georgia Institute of Technology, School of Polymer, Textile and Fiber Engineering, “Making Carbon Nanotube Forests: From Collective Growth Mechanics to Complex Materials”, February 2010.
18. Air Force Research Laboratory Carbon Nanotube Workshop, “Investigating the Collective Dynamics of Carbon Nanotube Forest Growth”, November 2009.
17. Architectural Record Innovation Conference, “Making Nanostructures: From Atomic-Scale Mechanisms to Programmable Building Materials”, October 2009.
16. DARPA Nano-MTO Workshop, “Principles and Demands for Precise Organization and Integration of Carbon Nanotubes in N/MEMS”, July 2009.
15. Georgia Institute of Technology, Department of Mechanical Engineering, “Making Massive Crowds of Nanotubes: Growth Mechanisms, Microstructures, and Composite Materials”, September 2008.
14. Cornell University, “Revealing the Dynamics of Carbon Nanotube Forest Growth by *In Situ* X-Ray Scattering”, June 2008.

13. TNG Tech Day (Munich, Germany), “Massive Crowds of Nanostructures: Synthesis and Applications”, May 2008.
12. University of Michigan, Department of Electrical Engineering and Computer Science, WIMS Seminar Series, “Making Massive Crowds of Nanotubes: Growth Mechanisms, Microstructures, and Composite Materials”, April 2008.
11. Instituto Tecnológico de Aeronáutica (São José dos Campos, Brazil), “Manufacturing of Carbon Nanotubes”, June 2007.
9. 10th Annual Nano Science and Technology Institute Conference, “International Assessment of CNT Manufacturing and Applications”, keynote in Session on CNT Manufacturing Progress, May 2007.
8. Massachusetts Institute of Technology, Department of Mechanical Engineering, “Manufacturing of Carbon Nanotube Films: From Atomic-Scale Growth Mechanisms to Airplane-Scale Composites”, May 2007.
7. Boston University, School of Fine Arts, “Nanobliss: Creating and Imaging Microscopic Landscapes of Carbon and Silicon”, April 2007.
6. Harvard University, Materials Science Seminar, “Manufacturing of Carbon Nanotube Films: From Atomic-Scale Growth Mechanisms to Airplane-Scale Composites”, April 2007.
5. NSF/WTEC Workshop on Research and Development on Carbon Nanotubes “Electronic Applications of Carbon Nanotubes”, November 2006.
4. US-China Workshop on Carbon Nanotube Manufacturing (Beijing, China), “Chemical, Mechanical, and Thermal Control of Substrate-Bound Carbon Nanotube Growth”, September 2006.
3. MIT Small-Talks Student Seminar Series, “Adventures in Carbon Nanotube Growth: from the Atomic Scale to the Airplane Scale and Beyond”, October 2006.
3. Senturia Prize lecture in MIT Micro-Nano Seminar Series (MNSS), “Synthesis of Carbon Nanotubes: Toward New Systems for Science and Manufacturing”, May 2006. Also presented in 2006 at McGill University, University of Edinburgh, Technical University of Eindhoven, University of Illinois, and University of Michigan.
2. MIT Deshpande Center IdeaStream Conference, “Carbon Nanotubes: Old Material, New Momentum”, April 2005.
1. Forum of CIMIT Innovative Technology for Medicine, “Kinematic Couplings and Modular Interfaces”, April 2002.

PATENTS

1. A.J. Hart, A.H. Slocum. Methods and Devices for Growth and/or Assembly of Nanostructures, issued, 2011.
2. A.J. Hart, A.H. Slocum. Shape-Controlled Growth of Nanostructured Films and Objects, U.S. Patent 7,976,815, issued July 12, 2011, <http://www.google.com/patents?id=umjnAQAAEBAJ>.
3. A.H. Slocum, S. Awtar, A.J. Hart. Material Transportation System. US Patent 6,886,651, issued May 3, 2005, <http://www.google.com/patents?id=JusTAAAAEBAJ>.

11 additional patents pending as of October 2011.

BOOKS

1. G.D. Nessim, C.L. Pint, A.J. Hart. Carbon Nanotube Synthesis: from the laboratory to the manufacturing plant. Springer, to be published in 2012.

BOOK CHAPTERS AND REPORTS

2. A.J. Hart, S. Park, M. De Volder, S. Tawfick, E.R. Meshot. "Principles and methods of integration of carbon nanotubes in miniaturized systems", Chapter in MEMS and Nanotechnologies: From Science to Electronic Systems. Bentham Science, to be published in 2011.
1. A.J. Hart, A. Rinzler, and J. Kong. "Electronic, optical, and optoelectronic applications of carbon nanotubes", Chapter 6 in WTEC/NSF Report on Carbon Nanotube Manufacturing and Applications, 2007, <http://www.wtec.org/cnm>.

TEACHING EXPERIENCE

The Ph.D. Research Process (U. Michigan, ME599) Winter 2011

- Created and taught new graduate course on research skills and methods for Ph.D. students. Topics include: identification of research questions, literature searching, teamwork and advising, the scientific method, writing proposals and papers, data management and visualization, and research presentations.

Nanomanufacturing (U. Michigan, ME599) Fall 2007, Winter 2009, Winter 2010

- Created and taught new graduate course on properties, synthesis, and assembly of nanostructured materials. Lectures online at <http://www.mechanosynthesis.com>.
- Course co-listed with Master of Engineering programs in Energy Systems, Integrated Microsystems, and Manufacturing.

Design and Manufacturing III (U. Michigan, ME450) Fall 2008

- Senior capstone design course with concept-to-prototype team project. Shared full course lecture (100 students) with three other faculty, and created and taught theme project section "Machines and instruments for small-scale science and manufacturing".

Design and Manufacturing I (U. Michigan, ME250) Winter 2008; Fall 2009, 2010, 2011

- Core sophomore-level course including the creative design process, 3D modeling, basics of materials and mechanical components, and manufacturing processes.
- Designed, managed, and implemented comprehensive revision of course content during Fall 2009 semester, including semester-long project that culminates in a design competition.

Lab Instructor, Wheelchair Design in Developing Countries (MIT, SP.784) Spring 2007

- Guided a team of three undergraduate students on design and prototyping of a frame for hand-powered tricycle wheelchairs; http://web.mit.edu/sp.784/www/course_info.html.

Section Instructor, Introduction to Design and Manufacturing (MIT, 2.007) Spring 2006

- Core undergraduate course teaches engineering design process, machine kinematics, structures, and power transmission elements.
- Co-taught lab section of ten students through a semester-long design-and-build project of a remote-controlled machine, from concept-to-prototype, culminating in an interactive competition.
- Created and guided experimental activity where students build semi-autonomous machines using optical and inertial sensors and microcontroller.

Co-instructor, "MEMS 101" short course (MIT) Jan. 2005 and 2006

- Developed and taught five-hour short course along with four other graduate students.
- Topics included silicon and polymer microfabrication, MEMS sensors and actuators, packaging, wafer bonding, and nanomaterials.

Project advisor to "i-Teams" entrepreneurship course (MIT, 15.371) Fall 2005

- Topics included silicon and polymer microfabrication, MEMS sensors and actuators, packaging, wafer bonding, and nanomaterials.
- Worked throughout the semester with a team of five engineering and business graduate students who evaluated the commercialization potential for materials utilizing long carbon nanotubes.

ACADEMIC AND PROFESSIONAL ACTIVITIES

Internal Service at UM

Advisory Committee, Center for Entrepreneurship, 2011-Present
Advisory Council, Energy Systems Engineering Program, 2011-Present
Mechanical Engineering Graduate Admissions Committee, 2010-12
Mechanical Engineering Faculty Search Committee, 2009-10
Mechanical Engineering Seminar Committee, 2008-10 (Co-chair 2009-10)
Class of 1931E Scholarship Committee, 2010-Present

External Service

Review panelist:

NSF Nanomanufacturing Peer Review Panel, May 2008 and December 2010
DOE Early Career Review Panel, Materials Processing, January 2011
Organizing committee, NIST Workshop “Enabling the Carbon Nanomaterials Revolution: Metrology, markets, safety, and scale-up, February 2011
Co-organizer, Symposium on “Carbon nanostructures: from properties to applications”, International Conference on Advanced Materials (ICAM), Rio de Janeiro, Brazil, 2009
Principal Member, IEEE-1784 Nanoelectronic Standards Working Group, 2007-present
Member, ASME Micro/Nanosystems (MNS) Committee, 2007-9
Member of NSF/NIST/WTEC expert panel, “International Assessment Carbon Nanotube Manufacturing and Applications”, <http://www.wtec.org/cnm>, 2006-7
Co-founder and organizer of MIT “SmallTalks” interdisciplinary graduate student seminar series, with sponsorship from several departments, <http://web.mit.edu/small-talks>.
Founder and organizer of MIT carbon nanotube interest group, 2003-2007, which comprised over seventy students and faculty among many departments, and met regularly for seminars.

Professional Society Memberships

American Physical Society
American Society of Mechanical Engineers
American Society for Precision Engineering
European Society for Precision Engineering and Nanotechnology
Institute of Electrical and Electronics Engineers
Materials Research Society
Pi Tau Sigma, National Mechanical Engineering Honor Society
Tau Beta Pi, National Engineering Honor Society

Referee for

ACS Nano, 2007-11
ACS Applied Materials and Interfaces, 2009-11
Advanced Functional Materials, 2009
Advanced Materials, 2007-11
Angewandte Chemie, 2010
Applied Physics Letters, 2008-11
ASME Journal of Manufacturing Science and Engineering, 2007
ASME Journal of Heat Transfer, 2010
ASME Journal of Mechanical Design, 2010
Carbon, 2006-11
Chemistry of Materials, 2006-7
IEEE Transactions on Nanotechnology, 2009
Journal of Applied Physics, 2008
Journal of Electronic Materials, 2008

Journal of Materials Research, 2010
Journal of Nanoscience and Nanotechnology, 2007, 2009
Journal of Physical Chemistry, 2006-10
Journal of Physics D, 2006, 2008
Journal of the American Chemical Society, 2009
Materials Science and Engineering B, 2009
Nanoscale, 2010-11
Nanotechnology, 2006-8, 2011
Nano Letters, 2010
New Journal of Physics, 2007
Physica Status Solidi, 2007-8, 2011
Review of Scientific Instruments, 2009-11
Scripta Materialia, 2009
Small, 2007
Synthetic Metals, 2009

MEDIA COVERAGE AND OUTREACH

Nanobliss gallery of visualizations micro- and nanoscale structures, <http://www.nanobliss.com>, established January 2006. Work has been featured in Nature (image of the year “Nanobama”, 2008), Science, New Scientist, PC Magazine, SEED Magazine, American Scientist, and hundreds of newspapers, journals, trade publications, blogs, and broadcast and online media outlets around the world.

Research on carbon nanotube synthesis was featured in BBC documentary “Visions of the Future: The Quantum Revolution”, November 2007.

Gallery exhibitions of images of micro- and nanoscale structures:

- Finalist, Science as Art Competition, Materials Research Society, Boston, MA, December 2010
- Finalist, Science as Art Competition, Materials Research Society, San Francisco, CA, April 2010
- Contributor to “Imaging the Future”, Gallery Project, Ann Arbor, MI, May-June 2010.
- University of Michigan Faculty Art Exhibition, Ann Arbor, MI, November 2009.
- Center for Nanoscale Science and Engineering, State University of New York at Albany, April 2009.
- Second Prize, Science as Art Competition, Materials Research Society, Boston, MA, December 2008
- Installation at the Princeton Center for Theoretical Science, opened October 2008.
- Exhibit University of Michigan Faculty Art Exhibition, Ann Arbor, MI, November 2007.
- Exhibit at Eighth International Conference on the Science and Application of Nanotubes, Ouro Preto, Brazil, June 2007.
- Exhibit at Hertz Foundation Symposium, San Jose, CA, March 2007.
- Exhibit at CollisionCollective C9 show at Art Interactive in Cambridge, MA and Jewett Arts Center Gallery in Wellesley, MA, February 2006 (with R. Wartena, E. Marley, and A. Embry-Pelrine).
- Finalist, Science as Art Competition, Materials Research Society, San Francisco, CA, April 2006
- Finalist, Science as Art Competition, Materials Research Society, San Francisco, CA, April 2005