RAY H. BAUGHMAN

BUSINESS ADDRESS

University of Texas at Dallas, 800 West Campbell, Richardson, TX 75080
Office: 972-883-6538 Cell: 214-435-2892

EDUCATION

Harvard University: Ph.D. (1971) and M.S. (1966) in Materials Science
Carnegie-Mellon University: B.S. (1964) in Physics

EMPLOYMENT POSITIONS

University of Texas at Dallas (2001-present)

- Director of NanoTech Institute and Robert A. Welch Professor of Chemistry

Honeywell International (formerly called Allied Chemical and Allied Signal)

- Staff Scientist (70-73)
- Group Leader (74-78)
- Manager (78-90)
- Corporate Fellow (90-01)

RESEARCH INTERESTS

Nanoscale Self-Assembly	Carbon Nanotubes
Nanomaterials Processing	Artificial Muscles
Electronics/Optics/Magnetics	Ferroelectrics
Nanoscale Devices	New Forms of Carbon
Photonic Crystals	Auxetic Materials
Electrochemical Devices	Solid-State Synthesis
Highly Conducting Organic Polymers	Smart Textiles

HONORS

- Member of National Academy of Engineering (Elected 2008)
- Member of Academy of Medicine, Engineering and Science of Texas (Elected 2008)
- Fellow of National Academy of Inventors (Elected 2015)
- Foreign Member European Academy of Sciences (Elected 2015)
- Foreign Member of Russian Academy of Natural Sciences (Elected 1997)
- *Concurrent Professor* of Nanjing University, China (Elected 2002)
- *Advisory Professor* of Fudan University, China (Elected 2002)
- *Honorable Yang Shixiang Professor* of Nankai University (Elected 2010)
- *Honorable Tang Aoqing Professor* of Jilin University (Elected 2010)
- Fellow of Amer. Phys. Society, the Royal Soc. of Chemistry, and Amer. Inst. of Chemists
- Editorial Boards of *Science* (2000-), *Synthetic Metals* (1978-07) and *Int. J. of Nanosci.* (2002-)
- *Chemical Pioneer Award* of the American Institute Of Chemists (1995)
- *Cooperative Research Award in Polymer Science and Engineering* (PMSE, ACS, 1996)
- AlliedSignal Technical Achievement Awards for *Time-Temperature Indicators* (1988)*, Polyaniline Compositions and Applications* (1994), *Sonar Hydrophones* (1996)
- *New Materials Innovation Prize*, Avantex Intern. Forum for Innovative Textiles (2005)
- Scientific American 50 List (06), *NanoVic Prize* (Australia, 06); *Nano 50 Awards* (06 & 07)
- *CSIRO Metal for Technical Achievement* (Australia, 06)
- *Alumni Distinguished Achievement Award* of Carnegie Mellon University (2007)
- *Kapitza Metal* of Russian Academy of Natural Sciences (2007)
- *Honorary Graffin Lectureship* of the American Carbon Society (2009-2010)
- *Tech Titans Award in Education* (2011)
- Listed 30th on Top 100 Materials Scientists of the Decade (2000-2010)
- Time Magazines *50 Best Inventions of the Year* (2011)
- *European Network on Artificial Muscles* Award for pioneering work on artificial muscles (2012)
- *The SGL Carbon Award* of the American Carbon Society (2013)

- *2015 Inventor Award* for Energy Harvesting Materials and Systems
- *Tech Titans Inventors Award* (2015)
- R&D 100 Special Recognition Gold Award for Market Disruptor Product (2015)

UNDERGRADUATE PUBLICATIONS

1. "Preparation, Analysis, and X-Ray Diffraction Identification of Barbiturate Silver Salts", S.M. Sax, P.J. Migliore, R.H. Baughman, *Analytical Biochemistry* **3**, 150-157 (1962).

2. "A Study of Malignolipin Picrate", S.M. Sax, P.L. Harbison, M. Sax, R.H. Baughman, *J. of Biological Chemistry* **238**, 3817-3819 (1963).

3. "The Structure of the Morpholine β-Iodophenylacetylene Complex" R.H. Baughman, *J. of Organic Chemistry* **29**, 964-965 (1964).

LATER PUBLICATIONS

4. "NMR Calorimetric and Diffraction Study of Molecular Motion in Crystalline Carboranes", R.H. Baughman, *J. Chem. Phys.* **53**, 3781-3789 (1970).

5. "Vacancy Formation Parameters in Organic Crystals", R.H. Baughman and D. Turnbull, *J. Phys. Chem. Solids* **32**, 1375-1394 (1971).

6. "Diffraction Study of Solid State Photopolymerization of Trans,Trans-1,4- bis(β-Pyridyl-2-Vinyl) Benzene", R.H. Baughman, *J. Appl. Phys.* **42**, 4579-4584 (1971).

7. "Self-Diffusion in Crystalline Hexamethylethane and Cyclooctane", R.H. Baughman and D. Turnbull, *J. Phys. Chem. Solids* **33**, 121-128 (1972).

8. "Solid-State Polymerization of Diacetylenes", R.H. Baughman, *J. Appl. Phys.* **43**, 4362-4370 (1972).

9. "Negative Thermal Expansion in Crystalline Linear Polymers", R.H. Baughman, *J. Chem. Phys.* **58**, 2976-2983 (1973).

10. "Raman Spectral Changes During the Solid-State Polymerization of Diacetylenes", A.J. Melveger and R.H. Baughman, *J. Polym. Sci., Polym. Phys. Ed.* **11**, 603-619 (1973).

11. "Relevance of Cage Recombination in the Plastic Deformation of Polymers", L.A. Davis, R.H. Baughman, and C.A. Pampillo, *J. Polym. Sci., Polym. Phys. Ed.* **11**, 2441-2451 (1973).

12. "Negative Thermal Expansion of a Polydiacetylene Single Crystal", R.H. Baughman and E.A. Turi, *J. Polym. Sci., Polym. Phys. Ed.* **11**, 2453-2466 (1973).

13. "Raman Spectral Shifts Relevant to Electron Delocalization in Polydiacetylenes", R.H. Baughman, J.D. Witt, and K.C. Yee, *J. Chem. Phys.* **60**, 4755-4759 (1974).

14. "Solid-State Synthesis of Large Polymer Single Crystals", R.H. Baughman, *J. Polym. Sci., Polym. Phys. Ed.* **12**, 1511-1535 (1974).

15. "Electron Delocalization Contribution to Single Crystal Thermal Expansion of a Polydiacetylene", R.H. Baughman, C.J. Exarhos, and W.M. Risen, Jr., *J. Polym. Sci., Polym. Phys. Ed.* **12**, 2189-2193 (1974).

16. "Solid-State Polymerization of a Cyclic Diacetylene", R.H. Baughman and K.C. Yee, *J. Polym. Sci., Polym. Chem. Ed.* **12**, 2467-2475 (1974).

17. "Deformation and Microstructure of Extended-Chain Polydiacetylene Crystals", R.H. Baughman, H. Gleiter, and N. Sendfeld, *J. Polym. Sci., Polym. Phys. Ed*. **13**, 1871-1879 (1975).

18. "Resonance Raman Study of the Thermochromic Phase Transition of Polydiacetylene", G.J. Exarhos, W.M. Risen, Jr., and R.H. Baughman, *J. Am. Chem. Soc*. **98**, 481-487 (1976).

19. "A Theoretical Investigation of the Solid-State Synthesis of Polymeric Sulfur Nitride $(SN)_x$", R.H. Baughman, R.R. Chance, and M.J. Cohen, *J. Chem. Phys.* **64**, 1869-1876 (1976).

20. "Optical Nonlinearities in One-Dimensional Conjugated Polymer Crystals", C. Sauteret, J.P. Hermann, R. Frey, F. Pradere, J. Ducuing, R.H. Baughman, and R.R. Chance, *Phys. Rev. Lett.* **36**, 956-959 (1976).

21. "Photoconduction in Polydiacetylene Single Crystals", R.R. Chance and R.H. Baughman, *J. Chem. Phys.* **64**, 3889-3890 (1976).

22. "Optical Nonlinearities of Polymerized Diacetylenes", C. Sauteret, J.P. Hermann, R. Frey, F. Pradere, J. Ducuing, R.H. Baughman, and R.R. Chance, *Opt. Commun.* **18**, 55-56 (1976).

23. "Transient Photoconductivity of a Polydiacetylene Single Crystal", R.R. Chance, R.H. Baughman, P.J. Reucroft, and K. Takahashi, *Chem. Phys*. **13**, 181-185 (1976).

24. "A Laser Raman Study of the Stress Dependence of Vibrational Frequencies of a Monocrystalline Polydiacetylene", V.K. Mitra, W.M. Risen, Jr., and R.H. Baughman, *J. Chem. Phys*. **64**, 2731-2736 (1976).

25. "Comments on the Optical Properties of Fully Conjugated Polymers: Analogy Between Polyenes and Polydiacetylenes", R.H. Baughman and R.R. Chance, *J. Polym. Sci., Polym. Phys. Ed.* **14**, 2037-2045 (1976).

26. "The Nature and Origin of Structural Defects in Polymeric Sulfur Nitride", R.H. Baughman and R.R. Chance, *J. Polym. Sci., Polym. Phys. Ed*. **14**, 2019-2035 (1976).

27. "Point Defects in Fully Conjugated Polymers", R.H. Baughman and R.R. Chance, *J. Appl. Phys.* **47**, 4295-4300 (1976).

28. "The Solid-State Synthesis and Properties of Photoconducting, Metallic, and Superconducting Polymer Crystals", R.H. Baughman, *Contemp. Topics in Polym. Sci.* **2,** 205-233 (1977).

29. "Shear Transformation to Produce a New Phase of Polymeric Sulfur Nitride $(SN)_x$", R.H. Baughman, P.A. Apgar, R.R. Chance, A.G. MacDiarmid, and A.G. Garito, *J. Chem. Phys.* **66**, 401-409 (1977).

30. "A New Phase of Polymeric Sulfur Nitride", R.H. Baughman, P.A. Apgar, R.R. Chance, A.G. MacDiarmid, and A.F. Garito, *J. Chem. Soc., Chem. Commun.* **49-50** (1977).

31. "Electronic Structure Change at a Phase Transition in a Polydiacetylene Crystal", Z. Iqbal, R.R. Chance, and R.H. Baughman, *J. Chem. Phys.* **66**, 5520-5525 (1977).

32. "Thermochromism in a Polydiacetylene Crystal", R.R. Chance, R.H. Baughman, H. Mueller, and C.J. Eckhardt, *J. Chem. Phys*. **67**, 3616-3618 (1977).

33. "Optical and Electrical Properties of a Polydiacetylene Crystal: Poly(5,7-Dodecadiyne-1,12-diol-bisphenylurethane)", H. Mueller, C.J. Eckhardt, R.R. Chance, and R.H. Baughman, *Chem. Phys. Lett*. **50**, 22-25 (1977).

34. "Sample Modulated Raman Spectroscopy and Frequency Modulated Visible Light: Resonance Raman Spectrum of a Polydiacetylene Fiber", C.T. Tzinis, S.K. Bahl, P. Davidson, W.M. Risen, Jr., and R.H. Baughman, *Rev. Sci. Instrum.* **49**, 1725-1728 (1978).

35. "Deformation Mechanisms in Polymer Crystals. Part 1. The Geometry of the Stress-Induced Phase Change of Polymeric Sulfur Nitride $(SN)_x$", R.J. Young and R.H. Baughman, *J. Mater. Sci.* **13**, 55-61 (1978).

36. "Raman Scattering in Brominated Sulfur Nitride $(SN)_x$ Crystals", Z. Iqbal, R.H. Baughman, J. Kleppinger, and A.G. MacDiarmid, *Solid State Commun*. **25,** 409-413 (1978).

37. "Solid-State Reaction Kinetics in Single-Phase Polymerizations", R.H. Baughman, *J. Chem. Phys.* **68**, 3110-3121 (1978).

38. "The Structures of Cis-Polyacetylene and Highly Conducting Derivatives", R.H. Baughman, S.L. Hsu, G.P. Pez, and A.J. Signorelli, *J. Chem. Phys.* **68**, 5405-5409 (1978).

39. "Highly Conducting Iodine Derivatives of Polyacetylene: Raman, XPS, and X-Ray Diffraction Studies", S.L. Hsu, A.J. Signorelli, G.P. Pez, and R.H. Baughman, *J. Chem. Phys*. **69**, 106-111 (1978).

40. "Solid-State Polymerization of Linear and Cyclic Acetylenes", R.H. Baughman and K.C. Yee, *J. Polym. Sci., Macromol. Rev.* **13**, 219-239 (1978).

41. "Fully Conjugated Polymer Crystals: Solid-State Synthesis and Properties of the Polydiacetylenes", R.H. Baughman and R.R. Chance, *Ann. N.Y. Acad. Sci.* **313**, 705-725 (1978).

42. "New Metallic Linear Polymers", unsigned contributions by R.H. Baughman for *Physics News* in 1978, 51-53 (A.I.P. publications).

43. "Structure of Brominated Polysulfur Nitride $(SN)_x$: Raman Scattering and X-Ray Diffraction Studies", Z. Iqbal, R.H. Baughman, J. Kleppinger, and A.G. MacDiarmid, *Ann. N.Y. Acad. Sci.* **313**, 775-787 (1978).

44. "Structure of Brominated $(SN)_x$ and Tetrasulfur Tetranitride", Z. Iqbal, J. Sharma, R.H. Baughman, M. Akhtar, and A.G. MacDiarmid, Lecture Notes Physics, *Quasi One-Dimensional Conductors, Part 2 78***,** 432-436 (1979).

45. "Structural Perspectives for Polymeric Metals", R.H. Baughman, S.L. Hsu, L.R. Anderson, G. Pez, and A.J. Signorelli, *NATO Conf.* **Ser. 6**, 187-201 (1979).

46. "Static Lattice Calculations for Cis-Polyacetylene", R.H. Baughman and S.L. Hsu, *J. Polym. Sci., Polym. Lett. Ed.* **17**, 185-193 (1979).

47. "Characterization of the Ladder Polymerization of a Crystalline Cyclotetradiyne Monomer", A. Banerjie, J.B. Lando, K.C. Yee, and R.H. Baughman, *J. Polym. Sci*., *Polym. Phys. Ed*. **17**, 655-662 (1979).

48. "Polyacetylene and Highly Conducting Charge Transfer Complexes", R.H. Baughman, S.L. Hsu, and A.J. Signorelli, *Mol. Cryst. Liq. Cryst.* **52**, 555-561 (1979).

49. "Highly Conducting Charge-Transfer Complexes of Poly(p-phenylene)", D.M. Ivory, G.G. Miller, J.M. Sowa, L.W. Shacklette, R.R. Chance, and R.H. Baughman, *J. Chem. Phys.* **71**, 1506-1507 (1979).

50. "New Highly Conducting Polymers: Charge Transfer Complexes of Poly(p-phenylene)", R.H. Baughman, D.M. Ivory, G.G. Miller, L.W. Shacklette, and R.R. Chance, *Organic Coatings and Plastics Chemistry* **41**, 139-145 (1979).

51. "Electrical and Optical Properties of Highly Conducting Charge-Transfer Complexes of Poly(p-phenylene)", L.W. Shacklette, R.R. Chance, D. M. Ivory, G.G. Miller, and R.H. Baughman, *Synthetic Metals* **1**, 307-320 (1980).

52. "Highly Conducting Charge-Transfer Complexes of a Processible Polymer: Poly(p-phenylene Sulfide)", R.R. Chance, L.W. Shacklette, G.G. Miller, D.M. Ivory, J.M. Sowa, R.L. Elsenbaumer, and R.H. Baughman, *J.C.S. Chem. Comm.,* 348-349 (1980).

53. "Electronic Spectra of Two Polydiacetylene Isomorphs", R.R. Chance, K.C. Yee, R.H. Baughman, H. Eckhardt, and C.J. Eckhardt, *J. Polym. Sci., Polym. Phys. Ed.* **18**, 1651-1653 (1980).

54. "Theory of Single-Phase Solid-State Polymerization Reactions", R.H. Baughman and R.R. Chance, *J. Chem. Phys*. **73**, 4113-4125 (1980).

55. "Solid-State Synthesis of Highly Conducting Polyphenylene from Crystalline Oligomers", L.W. Shacklette, H. Eckhardt, R.R. Chance, G.G. Miller, D.M. Ivory, and R.H. Baughman, *J. Chem. Phys.* **73**, 4098-4102 (1980).

56. "Macromolecular Metals and Semiconductors: A Comparative Study", R.H. Baughman, R.R. Chance, R.L. Elsenbaumer, D.M. Ivory, G.G. Miller, A.F. Preziosi, and L.W. Shacklette, *Org. Coat. Plast. Chem.* **43**, 762-767 (1980) and *Polym. Sci. Technol.* **15**, 137-148 (Plenum, 1981).

57. "Conducting Complexes of a Processible Polymer: Poly(p-phenylene Sulfide)", R.R. Chance, L.W. Shacklette, H. Eckhardt, J.M. Sowa, R.L. Elsenbaumer, D.M. Ivory, G.G. Miller, and R.H. Baughman, *Polym. Sci., Technol.* **15**, 125-135 (Plenum, 1981).

58. "Highly Conducting Poly(p-phenylene) via Solid-State Polymerization of Oligomers", L.W. Shacklette, H. Eckhardt, R.R. Chance, G.G. Miller, D.M. Ivory, and R.H. Baughman, *Polym. Sci. Technol.* **15**, 115-123 (Plenum, 1981).

59. "Conducting Complexes of Polyphenylene Sulfides", L.W. Shacklette, R.L. Elsenbaumer, R.R. Chance, H. Eckhardt, J.E. Frommer, and R.H. Baughman, *J. Chem. Phys.* **75**, 1919-1927 (1981).

60. "Asymmetric Crystal Topography of Diacetylene and Polydiacetylene Macroscopic Single Crystals", R.G. Rosemeier, R.E. Greene, Jr., and R.H. Baughman, *J. Appl. Phys.* **52**, 7129-7135 (1981).

61. "Nonempirical Studies of the Electronic Properties of Highly Conducting Polymers", J.L. Bredas, R.R. Chance, R.H. Baughman, and R. Silbey, *Int. J. Quantum Chem.* **15**, 231-241 (1981).

62. "Conducting Complexes of Conjugated Polymers", H. Eckhardt, R.H. Baughman, J.L. Bredas, R.R. Chance, R.L. Elsenbaumer, and L.W. Shacklette, *Mater. Sci.* **7**, 121-126 (1981).

63. "Diacetylene Monomers and Polymers with Chiral Substituents: Structure, Solid-State Polymerization, and Properties", R.B. Wilson, E.N. Duesler, D.Y. Curtin, I.C. Paul, R.H. Baughman, and A.F. Preziosi, *J. Am. Chem. Soc*. **104**, 509-516 (1982).

64. "Conducting Complexes of Conjugated Polymers: A Comparative Study", R. R. Chance, R.H. Baughman, J.L. Bredas, H. Eckhardt, R.L. Elsenbaumer, J.E. Frommer, L.W. Shacklette, and R. Sibley, *Mol. Cryst. Liq. Cryst.* **83**, 1249-1259 (1982).

65. "Structural Basis for Semiconducting and Metallic Polymer Dopant Systems", R.H. Baughman, J.L. Bredas, R.R. Chance, R.L. Elsenbaumer, and L.W. Shacklette, *Chem. Rev.* **82**, 209-222 (1982).

66. "*Ab Initio* Effective Hamiltonian Study of the Electronic Properties of Conjugated Polymers", J.L. Bredas, R.R. Chance, R.H. Baughman, and R. Silbey, *J. Chem. Phys.* **76**, 3673-3678 (1982).

67. "Electrochemical Doping of Poly(p-phenylene) with Application to Organic Batteries", L.W. Shacklette, R.L. Elsenbaumer, R.R. Chance, J.M. Sowa, D.M. Ivory, G.G. Miller, and R.H. Baughman, *. Chem. Soc., Chem. Commun.*, 361-362 (1982).

68. "Electrically Conducting Polyaromatic Sulfides", R.L. Elsenbaumer, L.W. Shacklette, J.W. Sowa, and R.H. Baughman, *Mol. Cryst. Liq. Cryst.* **83**, 229-238 (1982).

69. "Interchain Contributions to Soliton Properties in Polyacetylene", R.H. Baughman and G. Moss, *J. Chem. Phys.* **77**, 6321-6336 (1982).

70. "Nonlinear Optical Properties of Polydiacetylenes", R.R. Chance, M.L. Shand, and R.H. Baughman, *A.C.S. Polymer Preprints* **23**, No. 2, 141 (1982).

71. "Organic Batteries Based on Polyphenylenes", R.L. Elsenbaumer, L.W. Shacklette, J.M. Sowa, R.R. Chance, D.M. Ivory, G.G. Miller, and R.H. Baughman, *Polym. Prepr.* **23**, 132-133 (1982).

72. "Conducting Polymers - Synthesis, Properties, and Device Potential", R.H. Baughman, R.R. Chance, H. Eckhardt, R.L. Elsenbaumer, J.E. Frommer, D.M. Ivory, G.G. Miller, A.F. Preziosi, and L.W. Shacklette, *Polym. Preprints (Am. Chem. Soc., Div. Polym. Chem.)* **23**, No. 1, pp. 130-131 (1982).

73. "Organic Batteries Based on Conductive Polymers", L.W. Shacklette, R.R. Chance, R.L. Elsenbaumer, and R.H. Baughman, *30th Power Sources, Electrochem. Soc. Conf. Procs.,* pp. 66-68 (1982).

74. "Theoretical Study of the Electronic Properties of Biphenylene Polymers: Prediction of New Highly Conducting Polymer Complexes", J.L. Bredas and R.H. Baughman, *J. Poly. Sci., Polym. Letter Ed.* **21**, 475-479 (1983).

75. "Staging in Polyacetylene-Iodine Conductors", R.H. Baughman, N.S. Murthy, G.G. Miller, and L.W. Shacklette, *J. Chem. Phys.* **79**, 1065-1074 (1983).

76. "The Structure of Metallic Complexes of Polyacetylene with Alkali Metals", R.H. Baughman, N.S. Murthy, and G.G. Miller, *J. Chem. Phys.* **79**, 515-520 (1983).

77. "Structure and Properties of Conducting Polyacetylene Complexes", R.H. Baughman, N.S. Murthy, G.G. Miller, L.W. Shacklette, and R.M. Metzger, *J. de Physique Colloque C3* **44**, 53-59 (1983).

78. "An In Situ EPR Study of Electrochemically Doped Trans Polyacetylene", L.D. Kispert, J. Joseph, T.V. Jayaraman, L.W. Shacklette, and R.H. Baughman, *J. de Physique Colloque C3* **44**, 317-320 (1983).

79. "Electrochemical Cells Employing Polyacetylene and Poly(p-phenylene) As Active Materials", L.W. Shacklette, R.L. Elsenbaumer, and R.H. Baughman, *J. de Physique Colloque C3* **44**, 559-563 (1983).

80. "Vibrational Spectra and Structure of Undoped and Doped Polyparaphenylene", Z. Iqbal, H. Bill, and R.H. Baughman, *J. de Physique Colloque C3* **44**, 761 (1983).

81. "Polymers as Electronic Materials - Today's Possibilities and Tomorrow's Dreams", R.H. Baughman, in Japanese in *Kobunshi* **33**, 247-254 (1984) and in English in *Contemporary Topics in Polymer Science* **5**, 321-350 (1984).

82. "Structural Changes During Annealing and during Acceptor Doping of Oriented Poly(p-phenylene Sulfide)", N.S. Murthy, R.L. Elsenbaumer, J.E. Frommer, and R.H. Baughman, *Synthetic Metals* **9**, 91-96 (1984).

83. "Conducting Polymers Synthesized by Dopant-Induced Polymerization of Insulating Charge-Transfer Crystals", H. Eckhardt, G.G. Miller, and R.H. Baughman, *Synthetic Metals* **9**, 441-450 (1984).

84. "EPR Study of Polarons in a Conducting Polymer with Nondegenerate Ground States: Alkali Metal Complexes of Poly(p-phenylene) and Phenylene Oligomers", L.D. Kispert, J. Joseph, G.G. Miller, and R.H. Baughman, *J. Chem. Phys.* **81**, 2119-2125 (1984).

85. "Electro-Reflectance Spectra of One-Dimensional Excitons in Polydiacetylene Crystals", Y. Tokura, Y. Oowaki, T. Koda, and R.H. Baughman, *Chem. Phys.* **88**, 437-442 (1984).

86. "Resonance Raman Spectra of Alkali-Metal Doped Polyacetylene", H. Eckhardt, L.W. Shacklette, J.S. Szobota, and R.H. Baughman, *Mol. Cryst. and Liq. Cryst.* **117**, 401-409 (1985).

87. "The Evolution of Structure During the Alkali-Metal Doping of Polyacetylene and Poly(p-phenylene)", R.H. Baughman, L.W. Shacklette, N.S. Murthy, G.G. Miller, and R.L. Elsenbaumer, *Mol. Cryst. and Liq. Cryst.* **118**, 253-261 (1985).

88. "Chiral Metals: Synthesis and Properties of a New Class of Conducting Polymers", R.L. Elsenbaumer, H. Eckhardt, Z. Iqbal, J. Toth, and R.H. Baughman, *Mol. Cryst. and Liq. Cryst.* **118**, 111-116 (1985).

89. "New Structural Phases of Polymer Battery Anode Materials: Alkali-Metal Doped Polyacetylene and Polyphenylene", L.W. Shacklette, N.S. Murthy, and R.H. Baughman, *Mol. Cryst. and Liq. Cryst.* **121**, 201-209 (1985).

90. "The Crystal Structure of Trans, Trans-1,3,5,7-Octatetraene as a Model for Fully-Ordered Trans-Polyacetylene", R.H. Baughman, B.E. Kohler, I.J. Levy, and C. Spangler, *Synthetic Metals* **11**, 37-53 (1985).

91. "EPR Study of Polarons In A Conducting Polymer with Nondegenerate Ground States: AsF_5 Complexes of Poly(p-phenylene)", L.D. Kispert, J. Joseph, G.G. Miller, and R.H. Baughman, *Mol. Cryst. and Liq. Cryst.* **118**, 313-318 (1985).

92. "The Synthesis, Properties, and Structures of Poly(peri-naphthalene: A Conducting, Undoped Organic Polymer", Z. Iqbal, D.M. Ivory, J. Marti, J.L. Bredas, and R.H. Baughman, *Mol. Cryst. and Liq. Cryst.* **118**, 103-109 (1985).

93. "Theoretical Study of the Electronic Properties and Crystal Structure of Poly(perinaphthalene): On the Origin of High Observed Conductivities", J.L. Bredas and R.H. Baughman, *J. Chem. Phys.* **83**, 1316-1322 (1985).

94. "Polyacetylene and Polyphenylene as Anode Materials for Nonaqueous Secondary Batteries", L.W. Shacklette, J.E. Toth, N.S. Murphy, and R.H. Baughman, *J. Electrochem. Soc.* **132**, 1529-1535 (1985).

95. "Thermal Enhancement of the Electrical Conductivities of Alkali Metal-Doped Polyacetylene Complexes", R.L. Elsenbaumer, P. Delannoy, G.G. Miller, C.E. Forbes, N.S. Murthy, H. Eckhardt, and R.H. Baughman, *Synthetic Metals* **11**, 251-270 (1985).

96. "Application of Diacetylene Monomers and Polymers as Color-Responsive Materials", R.H. Baughman and R.R. Chance, Polym. Prepr. *(Am. Chem. Soc., Div. Polym. Chem.)* **27**, 67-68 (1986).

97. "Characterization and Properties of Metallic Poly(carbon diselenide)", Y. Okamoto, L.S. Choi, Z. Iqbal, and R.H. Baughman, *Synthetic Metals* **15**, 281-288 (1986).

98. "Electrical Conductivity of Pristine and Doped Polyperinaphthalene", Z. Iqbal, C. Maleysson, and R.H.Baughman, *Synthetic Metals* **15**, 161-167 (1986).

99. "On the Question of Metallic and Superconducting Poly(carbon diselenide)", Z. Iqbal, Y. Khanna, N.S. Murthy, J.S. Szobota, C. Maleysson, R.H. Baughman, Y. Okamoto, and L.S. Choi, *J. Chem. Phys.* **85**, 4019-4027 (1986).

100. "Polyacetylene Formed by Benzoin Dianion Reduction of Poly(tetrafluoroethylene)", Z. Iqbal, D.M. Ivory, J.S. Szobota, R.L. Elsenbaumer, and R.H. Baughman, *J. Macromolecules* **19**, 2992-2996 (1986).

101. "The Dependence of Electronic Conductivity upon Conjugation Length for Conducting Polymers", R.H. Baughman and L.W. Shacklette, *Synthetic Metals* **17**, 173-181 (1987).

102. "Secondary Batteries with Electroactive Polymer Electrodes", L.W. Shacklette, bM. Maxfield, S. Gould, J.F. Wolf, T.R. Jow, and R.H. Baughman, *Synthetic Metals* **18**, 611-618 (1987).

103. "On the Question of Metallic Poly(carbon diselenide)", Y. Okamoto, L.S. Choi, Z. Iqbal, and R.H. Baughman, *Synthetic Metals* **18**, 265-273 (1987).

104. "Effect of Charge-Transfer on Chain Dimension in Trans-Polyacetylene", N.S. Murthy, L.W. Shacklette, and R.H. Baughman, *J. Chem. Phys.* **87**, 2346- (1987).

105. "Thermopower and Conductivity of Metallic Polyaniline", Y.W. Park, Y.S. Lee, C. Park, L.W. Shacklette, and R.H. Baughman, *J. Solid-State Commun.* **63**, 1063-1066 (1987).

106. "Structure-Property Predictions for New Planar Forms of Carbon: Layered Phases Containing sp^2 and sp Atoms", R.H. Baughman, H. Eckhardt, and M. Kertesz, *J. Chem. Phys.* **87**, 6687-6699 (1987).

107. "Carbophanes: A New Family of Crystalline Phases of Carbon", R. H. Baughman and W. B Hammond, *J. Chem. Phys.* **87**, 6687-6693 (1987).

108. "A Novel Application of Conducting Polymers: Remotely Readable Indicator Devices", R.H. Baughman, R.L. Elsenbaumer, Z. Iqbal, G.G. Miller, and H. Eckhardt, *Springer Ser. Solid-State Sci.* **76**, 432-349 (1988).

109. "Synthesis and Structure-Property Aspects of Poly(carbon diselenide)", Z. Iqbal, S.T. Correale, F. Reidinger, R.H. Baughman, and Y. Okamoto, *J. Chem. Phys.* **88**, 4492-4497 (1988).

110. "Structure and Properties of Polyaniline as Modeled by Single-Crystal Oligomers", L.W. Shacklette, J.F. Wolf, S. Gould, and R.H. Baughman, *J. Chem. Phys.* **88**, 3955-3961 (1988).

111. "Structure, Properties, and Thermodynamics of Poly(carbon dichalcogenides)", R.H. Baughman, Z. Iqbal, H. Eckhardt, and Y. Okamoto,*J. Macromolecules* **21**, 1832-1838 (1988).

112. "The Structure and Properties of Poly(carbon dichalcogenides)", Y. Okamoto, Z. Iqbal, and R.H. Baughman, *J. Macromol. Sci., Chem.* **25**, 799-810 (1988).

113. "Structure of Polyaceylene-Iodine Complexes", N.S. Murthy, G.G. Miller, and R.H. Baughman, *J. Chem. Phys.* **89**, 2523-2530 (1988).

114. "The Structure of a Novel Polymeric Metal: Acceptor-Doped Polyaniline", R.H. Baughman, J.F. Wolf, H. Eckhardt, and L.W. Shacklette, *Synthetic Metals* **25**, 121-137 (1988).

115. "Conductivity as a Function of Conjugation Length: Theory and Experiment for Conducting Polymer Complexes", R.H. Baughman and L.W. Shacklette, *Phys. Rev.* **B 39**, 5872-5886 (1989).

116. "Conjugation Length Dependent Transport in Conducting Polymers from a Resistor Network Model", R.H. Baughman and L.W. Shacklette, *J. Chem. Phys.* **90**, 7492-7504 (1989).

117. "Bismuth-Strontium-Calcium Cooper Oxide and Lead-Bismuth-Strontium-Calcium Copper Superconductors Films Via an Electrodeposition Process", M. Maxfield, H. Eckhardt, Z. Iqbal, F. Reidinger, and R.H. Baughman, *Appl. Phys. Lett.* **54**, 1932-1933 (1989).

118. "ESR Study of Coexisting Superconducting Phases in Bi-Sr-Ca-Cu-O Ceramics: New Features of the Low-Field Microwave Absorption", I.I. Khairullin, A.A. Zakhidov, P.K. Khabibulleav, Z. Iqbal, and R.H. Baughman, *Synthetic Metals* **33**, 243-256 (1989).

119. "Structure of Lithium-Doped Polyacetylene", N.S. Murthy, L.W. Shacklette, and R.H. Baughman, *Phys. Rev. B* **40**, 12550-12553 (1989).

120. "Structure and Staging in Polyacetylene Charge-Transfer Complexes", N.S. Murthy, L.W. Shacklette, and R.H. Baughman, *Solid-State Commun.* **72**, 267-270 (1989).

121. "The Effects of Intrachain Defects on the Electrical Anisotropy of Conducting Polymers", R.H. Baughman and L.W. Shacklette, in "Electronic Properties of Conjugated Polymers III", *Springer Series in Solid-State Sciences,* Vol. 91, 7-13 (1989).

122. "Structural Models for Alkali-Metal Complexes of Polyacetylene", N.S. Murthy, L.W. Shacklette, and R.H. Baughman, *Phys. Rev. B* **41**, 3708-3718 (1990).

123. "Conducting Polymer Electromechanical Actuators", R.H. Baughman, L.W. Shacklette, R.L. Elsenbaumer, E.J. Plichta, and C. Becht, in "Conjugated Polymeric Materials: Opportunities in Electronics, Optoelectronics, and Molecular Electronics", *NATO ASI Series E: Applied Sciences,* Vol. 182, 559-582 (Kluwer Academic Publishers, 1990).

124. "Defect Generation and Charge Transport in Polyaniline", L.W. Shacklette and R.H. Baughman, *Mol. Cryst. Liq. Cryst.* **189**, 193-212 (1990).

125. "Micro Electromechanical Actuators Based on Conducting Polymers", R.H. Baughman, L.W. Shacklette, R.L. Elsenbaumer, E.J. Plichta, and C. Becht, in "Molecular Electronics", 267-289 (Kluwer Academic Publishers, 1991).

126. "Microwave Absorption at Near-Zero Fields in Conducting Polymers", A.A. Zakhidov, I.I. Khairullin, V.Y. Sokolov, R.H. Baughman, Z. Iqbal, M. Maxfield, and B.L. Ramakrishna, *Synthetic Metals* **41-43**, 3717-3727 (1991).

127. "Application of Dopant-Induced Structure-Property Changes of Conducting Polymers", R.H. Baughman and L.W. Shacklette, in "Science and Applications of Conducting Polymers", Ed. W.R. Salaneck, D.T. Clark, and E.J. Samuelson, pp. 47-61 (Adam Hilger, New York, 1990).

128. "Superconductivity at 45K in Rb/Tl Codoped C_{60} and C_{60}/C_{70} Mixtures", Z. Iqbal, R.H. Baughman, B.L. Ramakrishina, S. Khare, N.S.Murthy, H.J. Bornemann, and D.E. Morris, *Science* **254**, 826 (1991).

129. "Superconducting Transition Temperature of Doped C_{60}: Retraction", Z. Iqbal, R.H. Baughman, B.L. Ramakrishna, S. Khare, N.S. Murthy, H.J. Bornemann and D.E. Morris, *Science* **256**, 950-951 (1992).

130. "A Hexagonal Structure for Alkali-Metal Doped Poly(p-phenylene)", N.S. Murthy, R.H. Baughman, L.W. Shacklette, H. Fark, and J. Fink, *Solid-State Commun.* **78**, 691-695 (1991).

131. "Conducting Polymers in Redox Devices and Intelligent Materials Systems", R.H. Baughman, *Makromolecular Chemie Macromol. Symp.* **51**, 193-215 (1991).

132. "Vibrational Properties and Defect Structures in Vinylene-Linked Low-Band-Gap Conducting Polymers", H. Eckhardt, R.H. Baughman, J.P. Buisson, S. Lefrant, C.X. Cui, and M. Kertesz, *Synthetic Metals* **43**, 3413-3419 (1991).

133. "Microwave Low-Field Absorption and ESR in $K_x(C_{60})_{l-y}$ $(C_{70})_y$ and K_x C_{70}", A.A. Zakhidov, K. Imaeda, A. Ugawa, K. Yakushi, H. Inokuchi, Z. Iqbal, and R.H. Baughman, *Physica C* **185-189**, 411-412 (1991).

134. "Structure Features in Alkali-Metal Doped Conjugated Polymers", N.S. Murthy, R.H. Baughman, and L.W. Shacklette, in *Frontiers of Polymer Research,* eds. P.N. Prasad and J.K. Nigam, pp. 385-394 (Plenum Press, New York, 1991).

135. "Polaron-Pair Generation in Poly(Phenylene Vinylenes), E.L. Frankevich, A.A. Lymarev, I. Sokolik, F.E. Karasz, S. Blumstengel, R.H. Baughman, and H.H. Hörhold, *Phys. Rev. B* **46**, 9320-9324 (1992).

136. "Charge Oscillation and Structure For Alkali-Metal Doped Polyacetylene", R.H. Baughman, N.S. Murthy, H. Eckhardt, and M. Kertesz, *Phys. Rev.* **B 46**, 10515-10539 (1992).

137. "Fullereneynes: A New Family of Porous Fullerenes", R.H. Baughman, D.S. Galvao, C. Cui, Y. Wang, and D. Tomanek, *Chem. Phys. Letter* **204**, 8-13 (1993).

138. "Polymers with Conjugated Chains in Three Dimensions", R.H. Baughman and C. Cui, *Synthetic Metals* **55**, 315-320 (1993).

139. "Tubulanes: Carbon Phases Based on Cross-linked Fullerene Tubules", R.H. Baughman and D.S. Galvão, *Chem. Phys. Lett.* **211**, 110-118 (1993).

140. "Crystalline Networks with Unusual Predicted Mechanical and Thermal Properties", R.H. Baughman and D.S. Galvão, *Nature* **365**, 735-737 (1993).

141. "Negative Volumetric Thermal Expansion for Proposed Hinged Phases",R.H. Baughman and D.S. Galvão, *Chem. Phys. Lett.* **240,** 180-184 (1995).

142. "Conducting Polymer Artificial Muscles", R.H. Baughman, *Synthetic Metals* **78**, 339-353 (1996).

143. "Improved Piezoelectric 0-3 Ceramic Particle/Polymer Composites", C. Cui, R.H. Baughman, Z. Iqbal, T.R. Kazmar, and D.K. Dahlstrom, *Proceedings of the Tenth IEEE International Symposium on Applications of Ferroelectrics*, Vol.2, 605-608 (1996).

144. "A Carbon Phase That Graphitizes At Room Temperature", R.H. Baughman, A.Y. Liu, C. Cui, and P.J. Schields, *Synthetic Metals* **86**, 2371-2374 (1997).

145. "Improved Piezoelectric Ceramic/Polymer Composites for Hydrophone Applications", C. Cui, R.H. Baughman, Z. Iqbal, T.R. Kazmar, and D.K. Dahlstrom, *Synthetic Metals* **85**, 1391-1392 (1997).

146. "Hinged and Chiral Polydiacetylene Carbon Crystals", R.H. Baughman, D.S. Galvão, C. Cui, and S.O. Dantas, *Chem. Phys. Lett.* **269,** 356-364 (1997).

147. "The Optical Properties of Porous Opal Crystals Infiltrated with Organic Molecules", K. Yoshino, K. Tada, M. Ozaki, A.A. Zakhidov, and R.H. Baughman, *Japanese J. Applied Physics* **36**, L714-717 (1997).

148. "Improved Piezoelectrics for Hydrophone Applications Based on Calcium-Modified Lead Titanate/Poly(vinylidene fluoride) Composites", C. Cui,

R.H. Baughman, Z. Iqbal, T.R. Kazmar, and D.K. Dahlstrom, *Sensors and Actuators* A **65**, 76-85 (1998).

149. "Negative Poisson's Ratios As a Common Feature of Cubic Metals", R.H. Baughman, J.M. Shacklette, A.A. Zakhidov, and S. Stafström, *Nature* **392**, 362-365 (1998).

150. "Materials With Negative Compressibilities in One or Higher Dimensions", R.H. Baughman, S. Stafström, C. Cui, and S.O. Dantas, *Science* **279**, 1522-1524 (1998).

151. "Materials with Negative Compressibilities", R.H. Baughman, S. Stafström, C. Cui, and S.O. Dantas, Science (Technical Comment in *This Week in Science*) **281**, 143 (1998).

152. "Direct Observations of Structural Phase Transitions in Planar Crystallized Ion Plasmas", T.B. Mitchell, J.J. Bollinger, D.H.E. Dubin, X.-P. Huang, W.M. Itano, R.H. Baughman, *Science* **282**, 1290-1293 (1998).

153. "Carbon Structures with Three-Dimensional Periodicity at Optical Wavelengths", A.A. Zakhidov, R.H. Baughman, Z. Iqbal, C. Cui, I. Khayrullin, S.O. Dantas, J. Marti, and V.G. Ralchenco, *Science* **282**, 897-901 (1998). The work described in this research article was also featured on the cover of *Science*.

154. "Nanostructured Thermoelectric Based on Periodic Composites from Opals and Opal Replicas: I. Bi-Infiltrated Opals", R.H. Baughman, A.A. Zakhidov, I.I. Khayrullin, I.A. Udod, C. Cui, G.U. Sumanasekera, L. Grigorian, P.C. Eklund, V. Browning, A. Ehrlich, Proc. 17th *Int. Conf. Thermoelectrics*, 288-293 (1998).

155. "Stimulated Emission in High-Gain Organic Media", S.V. Frolov, Z.V. Vardeny, K. Yoshino, A.A. Zakhidov, R.H. Baughman, *Phys. Rev. B* **59**, R5284-R5287 (1999).

156. "Laser-like Emission in Opal Photonic Crystals", S.V. Frolov, Z.V. Vardeny, A.A. Zakhidov, R.H. Baughman, *Optics Communications* **162**, 241-246 (1999).

157. "Carbon Nanotube Actuators", R.H. Baughman, C. Cui, A.A. Zakhidov, Z. Iqbal, J.N. Barisci, G.M. Spinks, G.G. Wallace, A. Mazzoldi, D. De Rossi, A.G. Rinzler, O. Jaschinski, S. Roth, M. Kertesz, *Science* **284**, 1340-1344 (1999).

158. "Comparison of Laser Action of Poly(2,5-dioctyloxy-p-phenylenevinylene) and Rhodamine 590", N. Eradat., M.N. Shkunov, S.V. Frolov, W. Gellermann, Z.V. Vardeny, A.A. Zakhidov, R.H. Baughman, K. Yoshino, *Synthetic Metals* **101**(1-3), 206-207 (1999).

159. "Stimulated Emission and Lasing in π-Conjugated Polymer Films, Microstructures, and Opal Photonic Crystals", Z.V. Vardeny, S.V. Frolov, D. Chinn, M.N. Shkunov, W. Gellermann, K. Yoshino, A. Fujii, R.V. Gregory,

R.H. Baughman, A.A. Zakhidov, Proc. SPIE - Int. Soc. Opt. Eng., Issue 3797(Organic Light-Emitting Materials and Devices III), 2-16 (1999).

160. “Electrical Properties of Periodic Porous Carbon Replica of Opal”, K. Yoshino, K. Hirotake, Y. Kawagishi, M. Ozaki, A.A. Zakhidov, R.H. Baughman, *Jpn. J. Appl. Phys.*, Part 1, **38**, 4926-4929 (1999).

161. “Nano-Engineered Thermoelectric Coating”, M. Toprak, Y. Zhang, M. Muhammed, A.A. Zakhidov, R.H. Baughman, I. Khayrullin, NATO Sci. Ser. 78 (Nanostructured Films and Coatings), 149-156 (2000).

162. “Fabrication and Characterization of Three-Dimensional Periodic Ferroelectric Polymer-Silica Opal Composites and Inverse Opals”, T.-B Xu, Z.-Y Cheng, Q.M. Zhang, R.H. Baughman, C. Cui, A.A. Zakhidov, J. Su, *J. Appl. Phys*. **88**, 405-409 (2000).

163. "Electrochemical Properties of Aligned Nanotube Arrays: Basis of New Electromechanical Actuators", M. Gao, L. Dai, R.H. Baughman, G.M. Spinks, G.G. Wallace, Proc. SPIE - Int. Soc. Opt. Eng., Issue 3987 (Electroactive Polymer Actuators and Devices),18-24 (2000).

164. "Direct Growth of Diamond Components", V. Ralachenko, L. Schirone, G. Sotgiu, A.A. Zakhidov, R.H. Baughman, A. Khomich, M. Nunuparov, I. Vlasov, V. Frolov, A. Karabutov, *Proc. - Electrochem. Soc.* 99-32 (Diamond Materials), 72-79 (2000).

165. “Negative Poisson’s Ratios for Extreme States of Matter”, R.H. Baughman, S.O. Dantes, S. Stafström, A.A. Zakhidov, T.B. Mitchell, D.H.E. Dubin, *Science* **288**, 2018-2022 (2000).

166. “Electrodeposited Nickel and Gold Nanoscale Metal Meshes with Potentially Interesting Photonic Properties”, L. Xu, J.B. Wiley, W.L. Zhou, C. Frommen, L. Malkinski, J.-Q. Wang, R.H. Baughman, A.A. Zakhidov, *Chem. Commun.* (12), 997-998 (2000).

167. “Optical and Electrical Properties of Opal Carbon Replica and Effect of Pyrolysis”, H. Kajii, Y. Kawagishi, H. Take, K. Yoshino, A.A. Zakhidov, R.H. Baughman, *J. Appl. Phys.* **88**, 758-763 (2000).

168. “Electrochemical Studies of Single-Wall Carbon Nanotubes in Aqueous Solutions“, J.N. Barisi, G.G. Wallace, and R.H. Baughman, *J. Electroanalytical Chem.* **488**, 92-98 (2000).

169. “Electrochemical Quartz Crystal Microbalance Studies of Single-Wall Nanotubes in Aqueous and Non-Aqueous Solutions”, J.N. Barisi, G.G. Wallace, and R.H. Baughman, *Electrochim. Acta* **46**, 509-517 (2000).

170. “Electrochemical Characterization of Single-Walled Carbon Nanotube Electrodes”, J.N. Barisi, G.G. Wallace, and R.H. Baughman, *J. Electrochem. Soc.* **147**, 4580-4583 (2000).

171. "Putting a New Spin on Carbon Nanotubes", R.H. Baughman, *Science* **290**, 1310-1311 (2000).

172. “Direct Growth of Diamond Components”, V. Ralachenko, L. Schirone, G. Sotgiu, A.A. Zakhidov, R.H. Baughman, A. Khomich, M. Nunuparov, I. Vlasov, V. Frolov, A. Karabutov, *Proc. - Electrochem. Soc.*, 99-32(Diamond Materials), 72-79 (2000).

173. "Studies of Optical Transitions Related to π-conjugated Polymers and Laser Dyes Infiltrated in Opal Photonic Crystals", N. Eradat, M. Wohlgenannt, Z.V. Vardeny, A.A. Zakhidov, R.H. Baughman, *Synthetic Metals* **116**, 509-513 (2001).

174. "Studies of Coherent Backscattering from Opal Photonic Crystals", J.D. Huang, M. Raikh, N. Eratat, Z.V. Vardeny, A.A. Zakhidov, R.H. Baughman, *Synthetic Metals* **116**, 505-507 (2001).

175. "Optical Studies of Metal-Infiltrated Opal Photonic Crystals", N. Eradat, J.D. Huang, Z.V. Vardeny, A.A. Zakhidov, I. Khayrullin, I. Udod, R.H. Baughman, *Synthetic Metals* **116**, 501-504 (2001).

176. "Photonic Versus Random Lasing in Opal Single Crystals", M.N. Shkunov, M.C. DeLong, M.E. Raikh, Z.V. Vardeny, A.A. Zakhidov, R.H. Baughman, *Synthetic Metals* **116**, 485-491 (2001).

177. "Three-Dimensionally Periodic Conductive Nanostructures: Network Versus Cermet Topologies for Metallic PBG", A.A. Zakhidov, R.H. Baughman, I.I. Khayrullin, I.A. Udod, M. Kozlov, N. Eradat, Z.V. Vardeny, M. Sigalas, R. Biswas, *Synthetic Metals* **116**, 419-426 (2001).

178. "Raman Scattering Study of Electrochemically Doped Single Wall Nanotubes", C.P. An, Z.V. Vardeny, Z. Iqbal, G. Spinks, R.H. Baughman, A.A. Zakhidov, *Synthetic Metals* **116**, 411-414 (2001).

179. "Metal Sphere Photonic Crystals by Nanomolding", L. Xu, W. Zhou, M.E. Kozlov, I.I. Khayrullin, I. Udod, A.A. Zakhidov, R.H. Baughman, and J.B. Wiley, *J. Am. Chem. Soc.* **123**, 763 (2001).

180. "Carbon Nanotube Actuators", G.M. Spinks, G.G. Wallace, R.H. Baughman, L. Dai, Chapter 8 in *Electroactive Polymer (EAP) Actuators as Artificial Muscles - Reality, Potential and Challenges*, edited by Joseph Bar-Cohen, SPIE Press (2001).

181. “X-ray Diffraction Evidence for the Formation of a Discotic Phase During Graphitization”, N.S. Murthy, S.O. Dantas, Z. Iqbal, and R.H. Baughman,

Carbon, **39**, 809-813 (2001).

182. "Electro-optic Behavior of Liquid Crystal-filled Silica Opal Photonic Crystals: Effect of Liquid Crystal Alignment", D. Kang, J.E. Maclennan, N.A. Clark, A.A. Zakhidov, and R.H. Baughman, *Phys. Rev. Lett.* **86**, 4052-4055 (2001).

183. "Electrochemically Driven Actuators from Conducting Polymers, Hydrogels, and Carbon Nanotubes", G.M. Spinks, G.G. Wallace, T.W. Lewis, L.S. Fifield, L. Dai, R.H. Baughman, Proc. SPIE - Int. Soc. Opt. Eng. 4234 (Smart Materials), 223-231 (2001).

184. "Microfabricated Electroactive Carbon Nanotube Actuators", A. Ahluwalia, R.H. Baughman, D. De Rossi, A. Mazzoldi, M. Tesconi, A. Tognetti, G. Vozzi, Proc. SPIE - Int. Soc. Opt. Eng. 4329 (Electroactive Polymer Actuators and Devices), 209-215 (2001).

185. "Conducting Polymer, Carbon Nanotube, and Hybrid Actuator Materials", G.M. Spinks, G.G. Wallace, C.D. Carter, D. Zhou, L.S. Fifield, C.R. Kincaid, R.H. Baughman, Proceedings of SPIE -The International Society for Optical Engineering 4329 (Electroactive Polymer Actuators and Devices), 199-208 (2001).

186. "Anomalous Coherent Backscattering of Light from Opal Photonic Crystals", J. Huang, M.E. Raikh, N. Eradat, Z.V. Vardeny, A.A. Zakhidov, and R.H. Baughman, *Phys. Rev. Lett*. **86**, 4815-4818 (2001).

187. "Chemical Route to Nano-engineered Skutterudites" M. Toprak, Yu Zhang, M. Muhammed. A.A. Zakhidov, R.H. Baughman, and I. Khayrullin, *Proc. 18th International Conference on Thermoelectrics*, pp. 382-385 (2001).

188. "Towards the Demonstration of Actuator Properties of a Single Carbon Nanotube", J. Fraysse, A.I. Minett, G. Gu, S. Roth, A.G. Rinzler, R.H. Baughman, *Current Applied Physics* **1**, 407-411 (2001).

189. "Tunable, Gap-State Lasing in Switchable Directions for Opal Photonic Crystals", M.N. Shkunov, Z.V. Vardeny, M.C. DeLong, R.C. Polson, A.A. Zakhidov, R.H. Baughman, *Advanced Functional Materials* **12**, 21-26 (2002).

190. "Evidence for Braggoriton Excitations in Opal Photonic Crystals Infiltrated With Highly Polarizable Dyes", N. Eradat, A.Y. Sivachenko, M.E. Raikh, Z.V. Vardeny, A.A. Zakhidov, R.H. Baughman, *Applied Physics Letters* **80**, 3491-3493 (2002).

191. "Synthesis of SiC nanorods from Sheets of Single-walled Carbon Nanotubes", E. Muñoz, A.B. Dalton, S. Collins, A.A. Zakhidov, R.H. Baughman, W.L. Zhou, J. He, C.J. O'Connor, B. McCarthy, W.J. Blau, *Chem. Phys. Lett*. **359**, 397-402 (2002).

192. "Charge-Induced Anisotropic Distortions of Semiconducting and Metallic Carbon Nanotubes", Yu.N. Gartstein, A.A. Zakhidov, R.H. Baughman, *Phys. Rev. Lett.* **89**, 45503 (2002).

193. "Carbon Nanotubes – The Route Towards Applications", R.H. Baughman, A.A. Zakhidov, and W.A. de Heer, *Science* **297**, 787-792 (2002).

194. "Direct Electron Transfer of Glucose Oxidase on Carbon Nanotubes", A. Guiseppi-Elie, C. Lei, and R. H. Baughman, *Nanotechnology* **13**, 559-564 (2002).

195. "Dimensional Changes as a Function of Charge Injection for *trans*-Polyacetylene: a Density Functional Study", G. Sun, J. Kürti, M. Kertesz, R.H. Baughman, *J. Chem. Phys.* **117**, 7691-7697 (2002).

196. "Disassembling Three-Dimensional Metallo-Dielectric Photonic Crystals into Metallic Photonic Crystal Sheets and Wires", F. Li, L. Xu, W.L. Zhou, J. He, R.H. Baughman, A.A. Zakhidov, and J.B. Wiley, *Advanced Materials* **14**, 1528-1531 (2002).

197. "Pneumatic Carbon Nanotube Actuators", G.M. Spinks, G.G. Wallace, L.S. Fifield, L.R. Dalton, A. Mazzoldi, D. De Rossi, I.I. Khayrullin, R.H. Baughman, *Advanced Materials* **14**, 1728-1732 (2002).

198. "Optical Characteristics of SiO_2 Photonic Bandgap Crystal with Ferroelectric Perovskite Oxide", B. G. Kim, K. S. Parikh, G. Ussery, A. A. Zakhidov, R.H. Baughman, E. Yablonovitch, and B. S. Dunn, *Applied Physics Letters* **81**, 4440-4442 (2002).

199. "Dimensional Changes as a Function of Charge Injection in Single Walled Carbon Nanotubes, G. Sun, J. Kürti, M. Kertesz, R.H. Baughman, *J. Am. Chem. Soc.* **124**, 15076-15080 (2002).

200. "Controlled Assembly of Carbon Nanotubes by Designed Amphiphilic Peptide Helices", G. G. Dieckmann, A. B. Dalton, P. A. Johnson, J. Razal, J. Chen, G. M. Giordano, E. Munoz, I. H. Musselman, R. H. Baughman, and R. K. Draper, *Journal of the American Chemical Society* **125**, 1770-1777 (2003).

201. "Improving the Mechanical Properties of Single-Walled Carbon Nanotube Sheets by Intercalation of Polymeric Adhesives", J. N. Coleman, W. J. Blau, A. B. Dalton, E. Muñoz, S. Collins, B. G. Kim, J. Razal, M. Selvidge, G. Vieiro, R. H. Baughman, *Applied Physics Letters* **82,** 1682-1684 (2003).

202. "Super Tough Carbon-Nanotube Fibres", A.B. Dalton, S. Collins, E. Muñoz, J. M. Razal, V.H. Ebron, J.P. Ferraris, J.N. Coleman, B.G. Kim, and R.H. Baughman, *Nature* **423**, 703 (2003).

203. "Muscles Made from Metals", R.H. Baughman, *Science* **300**, 268-269 (2003).

204. "V_2O_5 Nanotube Actuators", G. Gu, M. Schmid, P.-W. Chiu, A. Minett, J. Fraysse, G.-T. Kim, S. Roth, M. Kozlov, E. Muñoz, and R. H. Baughman, *Nature Materials* **2**, 316-319 (2003).

205. "Dynamic Light Scattering from Acoustic Modes in Single-Walled Carbon Nanotubes", C.E. Bottani, A. Li Bassi, M.G. Beghi, A. Podesta, P. Milani, A.A. Zakhidov, R. Baughman, D.A. Walters, R.E. Smalley, *Physical Review B* **67**, 155407-155412 (2003).

206. "Inelastic Light Scattering from Magnetically Aligned Single-Walled Carbon Nanotubes and Estimate of Their Two-Dimensional Young's Modulus", A. Li Bassi, M.G. Beghi, C.S. Casari, C.E. Bottani, A. Podesta, P. Milani, A.A. Zakhidov, R. Baughman, D.A. Walters, R.E. Smalley*, Diamond and Related Materials* **12**, 806-810 (2003).

207. "Variations of the Geometries and Band Gaps of Single Walled Carbon Nanotubes and the Effect of Charge Injection", G. Sun, J. Kurti, M. Kertesz, R.H. Baughman, *J. of Physical Chemistry* B **107**, 6924-6931 (2003).

208. "Graphyne Nanotubes: New Families of Carbon Nanotubes", V.R. Coluci, S.F. Braga, S.B. Legoas, D.S. Galvao, R.H. Baughman, *Materials Research Society Symposium Proceedings* **739,**175-180 (2003).

209. "Mechanical Properties of Hybrid Polymer Nanotube Systems", J.N. Coleman, M. Cadek, A.B. Dalton, E. Muñoz, J. Razal, R.H. Baughman, W.J. Blau, *Proceedings of SPIE - The International Society for Optical Engineering* **5118** (Nanotechnology), 271-279 (2003).

210. "Families of Carbon Nanotubes: Graphyne-Based Nanotubes", V.R. Coluci, S.F. Braga, S.B. Legoas, D.S. Galvao, R.H. Baughman, *Phys. Rev.* B **68**, 35430-35435 (2003).

211. "Increased Actuation Rate of Electromechanical Carbon Nanotube Actuators Using Potential Pulses with Resistance Compensation", J. N. Barisci, G. M. Spinks, G. G. Wallace, J. D. Madden, R. H. Baughman, *Journal of Smart Materials and Structures*, **12**, 549-555 (2003).

212. "Electrochemical Properties of Single-Wall Carbon Nanotube Electrodes", J.N. Barisci, G.G. Wallace, D. Chattopadhyay, F. Papadimitrakopoulos, R.H. Baughman, *J. Electrochem.Soc*. **150**, E409-E415 (2003).

213. "Mechanical and Electromechanical Coupling in Carbon Nanotube Distortions", Yu.N. Gartstein, A.A. Zakhidov, and R.H. Baughman, *Phys. Rev.* B **68**, 115415-115425 (2003).

214. "Synthesis and Magnetic Characterization of Periodic Nickel Sphere Arrays", L. Xu, L.D. Tung, L. Spinu, J.B. Wiley, A.A. Zakhidov, R.H. Baughman, *Advanced Materials* **15**, 1562-1564 (2003).

215. "Dimensional Change as a Function of Charge Injection in Graphite Intercalation Compounds: A Density Functional Theory Study", G. Sun, M. Kertesz, J. Kürti, R.H. Baughman, *Phys. Rev. B* **68**, 125411-125417 (2003).

216. "Super-Tough Composite Carbon Nanotube Fibers for Electronic Textiles", R.H. Baughman, *Association of Asia Pacific Physical Societies Bulletin* **13**, No. 4, 13-15 (2003).

217. "Avoiding the Shrink", R.H. Baughman, *Nature* **425**, 667 (2003).

218. "Optical Fiber Switch Based on Carbon Nanotube Actuation", L.S. Fifield, A.M. Zipperer, R.H. Baughman, L.R. Dalton, *Materials Research Society Symposium Proceedings* **772** (Nanotube-based Devices), 17-22 (2003).

219. "Investigation of Ionic Liquids as Electrolytes for Carbon Nanotube Electrodes", J.N. Barisci, G.G. Wallace, D.R. MacFarlane, and R.H. Baughman, *Electrochemistry Communications* **6**, 22-27 (2003).

220. "Inverse Gold Photonic Crystals and Conjugated Polymer Coated Opals for Functional Materials", P. B. Landon, J. Gutierrez, J.P. Ferraris, I. L. Martinez, R. Giridharagopal, Y.-C. Wu, S. Lee, K. Parikh, J. Gillespie, G. Ussery, B. Karimi, R.H. Baughman, A.A. Zakhidov, and R. Glosser, *Physica B: Condensed Matter* **338**, 165-170 (2003).

221. "Photoinduced Charge Transfer in Poly(p-phenylene vinylene) Derivatives and Carbon Nanotube/C60 Composites", C. Yang, M. Wohlgenannt, Z.V. Vardeny, W.J. Blau, A.B. Dalton, R.H. Baughman, A.A. Zakhidov, *Physica B: Condensed Matter* **338**, 366-369 (2003).

222. "Mechanical Properties of Hybrid Polymer Nanotube Systems", J.N. Coleman, M. Cadek, A.B. Dalton, E. Muñoz, J.M. Razal, R.H. Baughman, and W.J. Blau, *Nanotechnology Proceedings of the SPIE* **5118**, 271-279 (2003).

223. "Ultrafast Spectroscopy of Excitons in Single-Walled Carbon Nanotubes", O.J. Korovyanko, C-X. Sheng, Z.V. Vardeny, A.B. Dalton and R.H. Baughman, *Phys. Rev. Lett.* **94**, 017403-1 to 017403-4 (2004).

224. "Topochemical Strategies and Experimental Results for the Rational Synthesis of Carbon Nanotubes of One Specified Type", R.H. Baughman, M.C. Biewer, J.P. Ferraris, and J.S. Lamba, *Synthetic Metals* **141**, 87-92 (2004).

225. "Continuous Carbon Nanotube Composite Fibers: Properties, Potential Applications, and Problems", A.B. Dalton, S. Collins, E. Muñoz, J. M. Razal, V.H. Ebron, J.P. Ferraris, J.N. Coleman, B.G. Kim, and R.H. Baughman, *J. Materials Chemistry* **14**, 1-3 (2004).

226. "Two-Step Template Synthesis of Metallic Colloidal Crystals", L. Xu, A.A. Zakhidov, R.H. Baughman, and J.B. Wiley, *Materials Research Society Symposium Proceedings*, Vol. EXS-2, 93-95 (2004).

227. "Mechanical Properties of Nanotube Sheets: Alterations in Joint Morphology and Achievable Moduli in Manufacturable Materials, L. Berhan, Y. B. Yi, A.M. Sastrya, E. Munoz, M. Selvidge, and R.H. Baughman, *J. Applied Physics* **95,** 4335-4345 (2004).

228. "Structure and Dynamics of Carbon Nanoscrolls", S.F. Braga, V.R. Coluci, S.B. Legoas, R. Giro, D.S. Galvão, and Ray H. Baughman, *Nano Letters* **42**, 881-884 (2004).

229. "Linear and Nonlinear Wave Propagation in Negative Refraction Metamaterials, V.M. Agranovich, Y.R. Shen, R.H. Baughman, and A.A. Zakhidov, *Phys. Rev.* B **69**, 165112-1 to 165112-7 (2004).

230. "Preparation and Characterization of Individual Peptide-Wrapped Single-Walled Carbon Nanotubes", V. Zorbas, A. Ortiz-Acevedo, A.B. Dalton, M.M. Yoshida, G.R. Dieckmann, R.K. Draper, R.H. Baughman, M. Jose-Yacaman, I.H. Musselman, J*. American Chemical Society* **126**, 7222-7227 (2004).

231. "Individualities and Average Behavior in the Physical Properties of Small Diameter Single-walled Carbon Nanotubes", J. Kurti, V. Zolyomi, M. Kertesz, G. Sun, R.H. Baughman, H. Kuzmany, *Carbon* **42**, 971-978 (2004).

232. "Theoretical Investigation of Electromechanical Effects for Graphyne Carbon Nanotubes", V. R. Coluci, D.S. Galvão, R. H. Baughman, *Journal of Chemical Physics* **121**, 3228 (2004).

233. "Multifunctional Carbon Nanotube Composite Fibers", E. Muñoz, A.B. Dalton, S. Collins, M. Kozlov, J. Razal, J.N. Coleman, B.G. Kim, V.H. Ebron, M. Selvidge, J.P. Ferraris and R.H. Baughman, *Advanced Engineering Materials* **10,** 801-804 (2004).

234. "Multifunctional Carbon Nanotube Yarns by Downsizing an Ancient Technology", M. Zhang, K. R. Atkinson, R. H. Baughman, *Science* **306**, 1358-1361 (2004).

235. "New Families of Carbon Nanotubes Based on Graphyne Motifs", V. R. Coluci, S. F. Braga, S. B. Legoas, D. S. Galvao, and R. H. Baughman, *Nanotechnology* **15**, S142-S149 (2004).

236. "Highly Effective Sulfated Zirconia Nanocatalysts Grown Out of Colloidal Silica at High Temperature", G. Zhu, C. Wang, Y. Zhang, N. Guo, Y. Zhao, R. Wang, S. Qiu, Y. Wei, and R. H. Baughman, *Chem, Eur. J.* **10**, 4750-4754 (2004).

237. "Optical Bulk and Surface Waves with Negative Refraction", V.M Agranovich, Y.R. Shen, R.H. Baughman A.A. Zakhidov, *Journal of Luminescence* **110**, 167-173 (2004).

238. "Hierarchical Self-Assembly of Peptide-Coated Carbon Nanotubes", A. B. Dalton, A. Ortiz-Acevedo, V. Zorbas, W. M. Sampson, S. Collins, J. Razal, M. M. Yoshida, R. H. Baughman, R. K. Draper, I. H. Musselman, M. Jose-Yacaman, G. R. Dieckmann, *Advanced Functional Materials* **14**, 1147-1151 (2004).

239. "A Soluble and Highly Functional Polyaniline-carbon Nanotube Composite", R. Sainz, A. M. Benito, M. T. Martinez, J. F. Galindo, J. Sotres, A.M. Baro, B. Corraze, O. Chauvet, A.B. Dalton, R.H. Baughman, W. K. Maser, *Nanotechnology,* **16**, S150-S154 (2005).

240. "Spinning Solid and Hollow Polymer-Free Carbon Nanotube Fibers", M. E. Kozlov, R. C. Capps, W. M. Sampson, V. H. Ebron, J. P. Ferraris, R. H. Baughman, *Advanced Materials* **17**, 614-617 (2005).

241. "Playing Nature's Game with Artificial Muscles", R. H. Baughman, *Science* **308**, 63-65 (2005).

242. "Exciton Dynamics in Single Walled Carbon Nanotubes: Transient Photoinduced Dichroism and Polarized Emission", C.-X. Sheng, Z.V. Vardeny, A.B. Dalton, R.H. Baughman, *Phys. Rev.* B **71**, 125427/1-125427/12 (2005).

243. "Highly Conducting Carbon Nanotube/Polyethylenimine Composite Fibers", E. Muñoz, D.-S. Suh, S. Collins, M. Selvidge, A. B. Dalton, B. G. Kim, J. M. Razal, G. Ussery, A. G. Rinzler, M. T. Martínez, and R. H. Baughman, *Advanced Materials* **17**, 1064-1067 (2005).

244. "Nanotube Network Transistors from Peptide-wrapped Single-Walled Carbon Nanotubes", M. in het Panhuis, S. Gowrisanker, D. J. Vanesko, C. A. Mire, H. Jia, H. Xie, R. H. Baughman, I. H. Musselman, B. E. Gnade, G. R. Dieckmann, and R. K. Draper, *Small* **1**, 820-823 (2005).

245. "Diameter-Selective Solubilization of Single-Walled Carbon Nanotubes by Reversible Cyclic Peptides", A. Ortiz-Acevedo, H. Xie, V. Zorbas, W. M. Sampson, A. B. Dalton, R. H. Baughman, R. K. Draper, I. H. Musselman, and G. R. Dieckmann, *J. Am. Chem. Soc.* **127**, 9512-9517 (2005).

246. "Importance of Aromatic Content for Peptide/Single-Walled Carbon Nanotube Interactions" V. Zorbas, A. L. Smith, H. Xie, A. Ortiz-Acevedo, A. B. Dalton, G. R. Dieckmann, R. K. Draper, R. H. Baughman, and I. H. Musselman, *J. Am. Chem. Soc.* **127**, 12323-12328 (2005).

247. "Carbon-Nanotube-Modified Electrodes for the Direct Bioelectrochemistry of Pseudoazurin". A. Guiseppi-Elie, S. Brahim, G. Wnek, R. H. Baughman, *NanoBiotechnology* **1**, 83-92 (2005).

248. "Strong, Transparent, Multifunctional Carbon Nanotube Sheets", M. Zhang, S. Fang, A. A. Zakhidov, S. B. Lee, A. E. Aliev, C. D. Williams, K. R. Atkinson, and R. H. Baughman, *Science* **309**, 1215-1219 (2005).

249. "Peptide Cross-Linking Modulated Stability and Assembly of Peptide-Wrapped Single-Walled Carbon Nanotubes", H. Xie, A. Ortiz-Acevedo, V. Zorbas, R. H. Baughman, R. K. Draper, I. Musselman, A. Dalton, G. R. Dieckmann, *J. of Materials Chemistry* **15**, 1734-1741 (2005).

250. "Ultrafast Exciton Dynamics in Isolated Single-Walled Nanotubes", C. X. Sheng, Z. V. Vardeny, A.B. Dalton, and R.H. Baughman, *Synthetic Metals* **155**, 254-257 (2005).

251. "Retrospective: Richard E. Smalley (1943-2005)" W.W. Adams and R.H. Baughman, *Science* **310**, 1916 (2005).

252. "Fuel Powered Artificial Muscles", V. H. Ebron, Z. Yang, D. J. Seyer, M. Kozlov, J. Oh, H. Xie, J. Razal, L. J. Hall, J. P. Ferraris, A. G. MacDiarmid and R.H. Baughman, *Science* **311**, 1580-1583 (2006).

253. "Fast Carbon Nanotube Charging and Actuation", J. D. W. Madden, J. N. Barisci, P. A. Anquetil, G. M. Spinks, G. G. Wallace, R. H. Baughman, and I. W. Hunter, *Advanced Materials* **18**, 870-873 (2006).

254. "Dangerously Seeking Linear Carbon", R. H. Baughman, *Science* **312**, 1009-1010 **(**2006).

255. "Chalcogenide Inverted Opal Photonic Crystal as Infrared Pigments", A. E. Aliev, A. A. Zakhidov, R. H. Baughman and E. Yablonovitch, *International Journal of Nanoscience* **5**, 157–172 (2006).

256. "Hydrogen Storage in Carbon Nanoscrolls: A Molecular Dynamics Study", V.R. Coluci, S. F. Braga, R. H. Baughman, and D. S. Galvão, *Materials Research Society Symposium Proceedings*, **885** (Hydrogen Cycle – Generation, Storage, and Fuel Cells), 153-158 (2006).

257. "Polymeric Solar Cells with Oriented and Strong Transparent Carbon Nanotube Anode", R. Ulbricht, X. Jiang, S. Lee, K. Inoue, M. Zhang, S. Fang, R. H. Baughman, and A. Zakhidov, *Physics Status Solidi* B **243**, 3528-3532 (2006).

258. "Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: Artificial Muscles, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications", R. H. Baughman, M. Zhang, S. Fang, A. A. Zakhidov, M. Kozlov, S. B. Lee, A. E. Aliev, S. Lee, C. D. Williams, and K. R. Atkinson, *Annual Conference Proceedings- Society of Vacuum Coaters*, **49th**, 466-469 (2006).

259. "Nanotubes and Much More", R. H. Baughman, *Nature Nanotechnology* **1**, 11 (2006).

260. "Towering Forests of Nanotube Trees", R. H. Baughman, *Nature Nanotechnology* **1**, 94-96 (2006).

261. "Fractionation of SWNT/Nucleic Acid Complexes by Agarose Gel Electrophoresis", A. A. Vetcher, S. Srinivasan, I. A. Vetcher, S. M. Abramov, M. Kozlov, R. H. Baughman, S. D. Levene, *Nanotechnology* **17**, 4263-4269 (2006).

262. "Pool Boiling Experiments On Multi-Walled Carbon Nanotube (MWCNT) Forests", H. S. Ahn, N. Sinha, M. Zhang, S. Fang, R. H. Baughman, D. Banerjee, *Journal of Heat Transfer* **133**, 1335-1342 (2006).

263. "Transparent Carbon Nanotube Sheets as 3-D Charge Collectors in Organic Solar Cells", R. Ulbricht, S. B. Lee, X. Jiang, K. Inoue, M. Zhang, S. Fang, R. H. Baughman, Anvar A. Zakhidov, *Solar Energy Materials & Solar Cells* **91**, 416–419 (2007). Selected, out of 3,100 oral and poster presentations, as one of the "Top Five Hot or Cool Papers" at the Spring 07 Materials Research Society Meeting.

264. "Preparation, Structural, and Calorimetric Characterization of Bicomponent Metallic Photonic Crystals", Invited paper of M. E. Kozlov, S. Murthy, I. Udod, I. A. Khayrullin, R. H. Baughman and A. A. Zakhidov, *Applied Physics A* **86**, 421-425 (2007).

265. "Superconductivity in Pb inverse opal", A. E. Aliev, S. B. Lee, A. A. Zakhidov, R. H. Baughman, *Physica* C **453**, 15–23 (2007).

266. "Prediction of the Hydrogen Storage Capacity of Carbon Nanoscrolls", V. R. Coluci, S. F. Braga, R. H. Baughman, and D. S. Galvão, *Phys. Rev.* B **75**, 125404/1-125404/6 (2007).

267. "Thermal Properties of Carbon Inverse Lattice Photonic Crystals", A. E. Aliev, S. B. Lee, R. H. Baughman, and A. A. Zakhidov, *Journal of Luminescence* **125**, 11-17 (2007).

268. "Fabrication and Mechanical Characterization of Carbon Nanotube Yarns, 3-D Braids, and Their Composites", A. Bogdanovich, P. Bradford, S. Fang, M. Zhang, R. H. Baughman, and H. Samuel, *SAMPE Journal* **43**, 6-19 (2007). Selected as best paper in the SAMPE conference.

269. "Electrochemical Actuation of Carbon Nanotube Yarns", T. Mirfakhrai, J. Oh, M. Kozlov, E. C. W. Fok, M. Zhang, S. Fang, R. H. Baughman, and J. D. Madden, Invited Paper in *Journal of Smart Materials and Structures* **16**, S243-S249 (2007).

270. "Polymer Artificial Muscles", T. Mirfakhrai, J. D. W. Madden and R. H. Baughman, invited review for *Materials Today* **10**, 30-38 (2007).

271. "Alan G. MacDiarmid (1927-2007)", *Science* **315**, 1678 (2007).

272. "Electrophoretic Fractionation of Carbon Nanotube Dispersions on Agarose Gels", A. A. Vetcher, J.-H. Fan, S. Srinivasan, I. A. Vetcher, T. Lin, S. M.

Abramov, R. Draper, M. Kozlov, R. H. Baughman, S. D. Levene, *International J. of Nanoscience* **6**, 1-7 (2007).

273. "Field Emission of Electrons by Carbon Nanotube Twist-Yarns", A. A. Zakhidov, R. Nanjundaswamy, A. N. Obraztsov, M. Zhang, S. Fang, V. I. Klesch, R. H. Baughman, A. A. Zakhidov, *Appl. Phys.* A **88**, 593-600 (2007).

274. "Multifunctional Carbon Nanotube Yarns and Transparent Sheets: Fabrication, Properties, and Applications", K. R. Atkinson, S. C. Hawkins, C. Huynh, C. Skourtis, J. Dai, M. Zhang, S. Fang, A. A. Zakhidov, S. B. Lee, A. E. Aliev, C. D. Williams and R. H. Baughman, *Physica* B: Condensed Matter **15**, 339-343 (2007).

275. "Hydrogen Storage in Carbon Nanoscrolls: An Atomistic Molecular Dynamics Study", S. F. Braga, V. R. Coluci, R. H. Baughman, and D. S. Galvão, *Chemical Physics Letters* **441**, 78-82 (2007).

276. "Capacitive Charging and Background Processes in Carbon Nanotube Yarn Actuators", T. Mirfakhrai, M. Kozlov, M. Zhang, S. Fang, R. H. Baughman, and J. D. W. Madden, *Proceedings of SPIE*, Vol. **6524**, 65241H, 1-12 (2007).

277. "Bulk FePt-based Nanocomposite Magnets with Enhanced Exchange Coupling", C.-B. Rong, V. Nandwana, N. Poudyal, J. P. Liu, M. E. Kozlov, R. H. Baughman, Y. Ding, and Z. L. Wang, *Journal of Applied Physics* **102**, 023908/1 to 7 (2007).

278. "Carbon Nanotube Foils for Electron Stripping in Tandem Accelerators", K. von Reden, M. Zhang, M. Meigs, E. Sichel, S. Fang, and R. H. Baughman, *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atom* **261**, 44-48 (2007).

279. "Amphiphilic Helical Peptide Enhances the Uptake of Single-Walled Carbon Nanotubes by living Cells", S.-F. Chin, R. H. Baughman, A. B. Dalton, G. R. Dieckmann, R. K. Draper, C. Mikoryak, I. H. Musselman, V. Zorba-Poenitzsch, and P. Pantano, *Experimental Biology and Medicine* **232**, 1236-1244 (2007).

280. "Arbitrarily Shaped Fiber Assemblies from Spun Carbon Nanotube Gel Fibers", J. M. Razal, J. N. Coleman, E. Muñoz, B. Lund, Y. Gogotsi, H. Ye, S. Collins, A. B. Dalton, and R. H. Baughman, *Advanced Functional Materials* **17**, 2918-2924 (2007).

281. "Robust Cell Migration and Neuronal Growth on Pristine Carbon Nanotube Sheets and Yarns", P. Galvan-Garcia, E. W. Keefer, F. Yang, M. Zhang, S. Fang, A. A. Zakhidov, R. H. Baughman, and M. I. Romero, *Journal of Biomaterials Science: Polymer Edition*, **18**, 1245-1261 (2007).

282. "Thermal Transport in MWNT Sheets and Yarns", A. E. Aliev, C. Guthy, P. A. Heiney, M. Zhang, S. Fang, A. A. Zakhidov, J. E. Fischer, and

R. H. Baughman, *Carbon* **45**, 2880-2888 (2007).

283. "Synthesis of Silicon Based Opal by Chemical Reduction of Silica Opal", A. E. Aliev, M. A. O. Royer, A. A. Zakhidov, and R. H. Baughman, *Mater. Res. Soc. Symp. Proc.*, Vol. 964, 0964-R03-12 (2007).

284. "Thermal Transport in MWNT Sheet: Extremely High Radiation from the Carbon Nanotube Surface", A. E. Aliev, C. Guthy, M. Zhang, A. A. Zakhidov, J. E. Fischer, R. H. Baughman, Materials Research Society Symposium Proceedings (2007), Volume Date 2006, 963E(Nanowires and Carbon Nanotubes--Science and Applications).

285. "Ranking the Affinity of Aromatic Residues for Carbon Nanotubes by Using Designed Surfactant Peptides", H. Xie, E. J. Becraft, R H. Baughman, A. B. Dalton, and G. R. Dieckmann, *J. of Peptide Science* **14**, 139-151 (2008).

286. "Carbon Nanotube Electroactive Polymer Materials: Opportunities and Challenges", L. Qu, Q. Peng, L. Dai, G. M. Spinks, G. G. Wallace, and R. H. Baughman, *Materials Research Society Bulletin* **33**, 215-224 (2008).

287. "High Thermal Stability of Carbon-Coated $L1_0$-FePt Nanoparticles Prepared by Salt-Matrix Annealing", C.-B. Rong, N. Poudyal, G. S. Chaubey, V. Nandwana, Y. Liu, Y. Q. Wu, M. J. Kramer, M. E. Kozlov, R. H. Baughman, and J. Ping Liu, *Journal of Applied Physics* **103**, 07E131-1 to 3 (2008).

288. "Sign Change of Poisson's Ratio for Carbon Nanotube Sheets", L. J. Hall, V. R. Coluci, D. S. Galvão, M. E. Kozlov, M. Zhang, S. O. Dantas, R. H. Baughman, *Science* **320**, 504-507 (2008).

289. "Carbon Nanotube Yarns: Sensors, Actuators, and Current Carriers", T. Mirfakhrai, M. Kozlov, S, Fang, M. Zhang, R. H. Baughman, J. D. Madden, *Proc. SPIE* **6927**, 692708 (2008).

290. "Preparation and Electrochemical Characterization of Porous SWNT-PPy Nanocomposite Sheets for Supercapacitor Applications", J. Oh, M. Kozlov, B. G. Kim, H-K Kim, R. H. Baughman, Y. H. Hwang, *Synthetic Metals* **158**, 638-641 (2008).

291. **"**Carbon Nanotube Yarns as High Load Actuators and Sensors", T. Mirfakhrai, J. Oh, M. Kozlov, S. Fang, M. Zhang, R. H. Baughman, and J. D. Madden, *Advances in Science and Technology* **61**, 65-74 (2008).

292. "Modeling the Auxetic Transition on Carbon Nanotube Sheets", V. R. Coluci, L. J. Hall, D. S. Galvão, M. E. Kozlov, M. Zhang, S. O. Dantas, and R. H. Baughman, *Phys. Rev.* B **78**, 115408 1-10 (2008).

293. "A Tough Nanofiber Hydrogel Incorporating Ferritin", M. K. Shin, S. I. Kim, S. J. Kim, B. J. Kim, I. So, M. E. Kozlov, J. Oh, R. H. Baughman, *Applied Physics Letters* **93**, 163902/1-163902/3 (2008).

294. "Multiwalled Carbon Nanotube Sheets as Transparent Electrodes in High Brightness Organic Light-Emitting Diodes", C. D. Williams, R. O. Robles, M. Zhang, S. Li, R. H. Baughman, and A. A. Zakhidov, *Applied Phys. Lett.* **93**, 183506/1-183506/3 (2008).

295. "Directional Growth of Conducting Polypyrrole and Polythiophene Wires" P. S. Thapa, D. J Yu, J. P. Wicksted, J. A. Hadwiger, J. N. Barisci, R. H. Baughman, and B. N. Flanders, *Applied Phys. Lett.* **94**, 033104 (2009).

296. "Giant Stroke, Superelastic Carbon Nanotube Aerogel Muscles", A. E. Aliev, J. Oh, M. E. Kozlov, A. A. Kuznetsov, S. Fang, A. F. Fonseca, R. Ovalle, M. D. Lima, M. H. Haque, Y. N. Gartstein, M. Zhang, A. A. Zakhidov, R. H. Baughman, *Science* **323**, 1575-1578 (2009).

297. "Carbon nanotube yarn actuators: an electrochemical impedance model", T. Mirfakhrai, J. Oh, M. Kozlov, S. Fang, M. Zhang, R. H. Baughman, J. D. Madden, *Journal of The Electrochemical Society,* **156**, K97-K103 (2009).

298. **"**Electrochemically Tuned Properties for Electrolyte-Free Carbon Nanotube Sheets**",** Al. A. Zakhidov, D.-S. Suh, A. A. Kuznetsov, J. N. Barisci, E. Muñoz, A. B. Dalton, S. Collins, V. H. Ebron, M. Zhang, J. P. Ferraris, A. A. Zakhidov and R. H. Baughman, *Advanced Functional Materials* **19**, 2266-2272 (2009).

299. "Photon drag effect in carbon nanotubes yarns", A. N. Obraztsov, D. A. Lyashenko, S. Fang, R. H. Baughman, P. A. Obraztsov, S. V. Garnov, Y. P. Svirko, *Applied Physics Letters* **94**, 231112-1 to 231112-3 (2009).

300. "Molecular, Supramolecular, and Macromolecular, Motors and Artificial Muscles", D. Li, Walter F. Paxton, R. H. Baughman, T. J. Huang, J. F. Stoddart, and P. S. Weiss, *MRS Bulletin* **34**, 671-681 (2009).

301. "Self-oscillations of Carbon Nanotube Twist-yarn During Field Emission", V. I. Kleshch, Al. A. Zakhidov, A. N. Obraztsov, E. D. Obraztsova, R. H. Baughman, *Physica Stat. Sol. B* **8**, 1-4 (2009).

302. "Electron field emission from transparent multiwalled carbon nanotube sheets for inverted field emission displays", Al. A. Kuznetzov, S. B. Lee, M. Zhang, R. H. Baughman, A. A. Zakhidov, *Carbon* **48**, 41-46 (2010).

303. "Thermal conductivity of carbon MWNT sheets: Black body radiation and quenching of phonon modes in nanotube bundles", A. E. Aliev, M. H. Lima, E. M. Silverman, and R. H. Baughman, *Nanotechnology* **21**, 035709, 11 pp (2010).

304. "Template Synthesis of Ordered Arrays of Mesoporous Titania Spheres", L. Xu, Z. Hua, Y. Yan, A. A. Zakhidov, R. H. Baughman, J.-F. Chen, *Chemical Communications* **46**, 1872-1874 (2010).

305. "Load transfer between cross-linked walls of a carbon nanotube" A. F. Fonseca, T. Borders, R. H. Baughman, K. Cho, *Phys. Rev.* B, **81**, 045429-1 to 7 (2010).

306. "Harvesting Waste Thermal Energy Using a Carbon-Nanotube-Based Thermo-Electrochemical Cell", R. Hu, B. A. Cola, N. Haram, J. N. Barisci, S. Lee, S. Stoughton, G. Wallace, C. Too, M. Thomas, A. Gestos, M. E. dela Cruz, J. P. Ferraris, A. A. Zakhidov, R. H. Baughman, *Nano Letters* **10**, 838-846 (2010).

307. "Elastomeric Conductive Composites Based on Carbon Nanotube Forests", M. K. Shin, J. Oh, Marcio Lima, Mikhail E. Kozlov, Seon Jeong Kim, and R. H. Baughman, *Advanced Materials* **22**, 2663-2667 (2010).

308. "An Explosive Thrust for Nanotubes", *Nature Materials* **9**, 385-386 (2010).

309. "Underwater Sound Generation Using Carbon Nanotube Projectors" A. E. Aliev, M. D. Lima, S. Fang, and R. H. Baughman, *Nano Letters* **10**, 2374-2380 (2010).

310. "Spinnable Carbon Nanotube Forests Grown on Thin, Flexible Metallic Substrates", Xavier Lepró, Márcio D. Lima, Ray H. Baughman, *Carbon* **48**, 3621-3627 (2010).

311. "Structure and Process Dependent Properties of Solid-State Spun Carbon Nanotube Yarns", S. Fang, M. Zhang, A. A. Zakhidov, and R. H. Baughman, *Journal of Physics: Condensed Matter* **22**, 334221, 6 pp (2010).

312. "Carbon Nanotube/Platinum (Pt) Sheet as Improved Cathode for Microbial Fuel Cells" D. V. P. Sanchez, P. Huynh, M. E. Kozlov, R. H. Baughman R. D. Vidic, M. Yun, *Energy and Fuels* **24**, 5897-5902 (2010).

313. "Structural Model for Dry-Drawing of Sheets and Yarns from Carbon Nanotube Forests", A. Kuznetsov, A. Fonseca, R. H. Baughman, A. A. Zakhidov, *ACS Nano* **5**, 985-993 (2011).

314. "Biscrolling Nanotube Sheets and Functional Guests into Yarns", M. D. Lima, S. Fang, X. Lepró, C. Lewis, R. Ovalle-Robles, J. Carretero-González, E. Castillo-Martínez, M. E. Kozlov, J. Oh, N. Rawat, C. S. Haines, M. H. Haque, V. Aare, S. Stoughton, A. A. Zakhidov, R. H. Baughman, *Science* **331**, 51-55 (2011).

315. "Mechanoelectrical Force Sensors Using Twisted Yarns of Carbon Nanotubes", T. Mirfakhrai, J. Oh, M. E. Kozlov, S. Fang, M. Zhang, R. H. Baughman, and J. D. W. Madden, *IEEE Transactions on Mechatronics* **16**, 90-97 (2011).

316. “Thermal Actuation of Graphene Oxide Nanoribbon Mats”, J. Oh, M. E. Kozlov, J. Carretero-González, E. Castillo-Martínez, R. H. Baughman, *Chemical Physics Letters* **505**, 31-36 (2011).

317. “Aligned, Isotropic, and Patterned Carbon Nanotube Substrates that Control the Growth and Alignment of Chinese Hamster Ovary Cells”, C. A. Abdullah, P. Asanithi, E. W. Brunner, I. Jurewicz, C. Bo, C. L. Azad, R. O. Robles, S. Fang, M. D. Lima, X. Lepro, S. Collins, R. H. Baughman, R. P. Sear, and A. B. Dalton, *Nanotechnology* **22**, 205102 (2011).

318. “Au-Doped Polyacrylonitrile-Polyaniline Core-Shell Electrospun Nanofibers Having High Field-Effect Mobilities”, W. Wang, Z. Li, X. Xu, B. Dong, H. Zhang, Z. Wang, C. Wang, R. H. Baughman, S. Fang, *Small* **7**, 597-600 (2011).

319. “Manufacturing polymer/carbon nanotube composite using a novel direct process”, C.-D. Tran, S. Lucas, D. G. Phillips, L. K. Randeniya, R. H. Baughman, and T. Tran-Cong, *Nanotechnology* **22**, 145302, 9 pp (2011).

320. “Artificial Muscles Based on Polypyrrole/Carbon Nanotube Laminates”, W. Zheng, J. M. Razal, P. G. Whitten, R. Ovalle-Robles, G. G. Wallace, R. H. Baughman, and G. M. Spinks, *Advanced Materials* **23**, 2966-2970 (2011).

321. **“**Electromechanical Actuators Based on Graphene and Graphene/Fe_3O_4 Hybrid Paper”, J. Liang, Y. Huang, J. Oh, M. Kozlov, D. Sui, S. Fang, R. H. Baughman, Y. Ma, Y. Chen, *Advanced Functional Materials* **21**, 3778-3784 (2011).

322. “A reel-wound carbon nanotube polarizer for terahertz frequencies”, J. Kyoung, E. Y. Jang, M. D. Lima, H.-R. Park, R. Ovalle Robles,X. Lepró, Y. H. Kim, R. H. Baughman, D.-S. Kim, *Nano Letters* **11**, 4227-4231 (2011).

323. "Mirage effect from thermally-modulated transparent carbon nanotube sheet", A. E. Aliev, Y. N. Gartstein, R. H. Baughman, *Nanotechnology* **22**, 435704 (10 pp) (2011).

324. “Torsional carbon nanotube artificial muscles”, J. Foroughi, G. M. Spinks, G. G. Wallace, J. Oh, M. E. Kozlov, S. Fang, T. Mirfakhrai, J. D. W. Madden , M. K. Shin , S. J. Kim, R. H. Baughman, *Science* **334**, 494-497 (2011).

325. “Photoinduced optical transparency in dye-sensitized solar cells containing graphene nanoribbons”, J. A. Velten, J. Carretero-González, E. Castillo-Martínez, J. Bykova, A. Cook, R. H. Baughman, A. A. Zakhidov, *Journal of Physical Chemistry C* **115**, 25125-25131 (2011).

326. “Electrical power from nanotube and graphene electrochemical thermal energy harvesters” T. J. Kang, S. Fang, M. E. Kozlov, C. S. Haines, N. Li, Y. H. Kim, Y. Chen, and R. H. Baughman, *Advanced Functional Materials* **22**, 477-489 (2012).

327. “Preparation and Characterization of Hybrid Conducting Polymer-Carbon Nanotube Yarn”, J. Foroughi, G. M. Spinks, S. R. Ghorbani, M. E. Kozlov, F. Safaei, G. Peleckis, G. G. Wallace, R. H. Baughman, *Nanoscale* **4**, 940-945 (2012).

328. ‘‘Synergistic toughening of composite fibres by self-alignment of reduced graphene oxide and carbon nanotubes”, M. K. Shin, B. Lee, S. H. Kim, J. A. Lee, G. M. Spinks, S. Gambhir, G. G. Wallace, M. E. Kozlov, R. H. Baughman, S. J. Kim, *Nature Communications* | 3:650 | DOI: 10.1038/ncomms1661| www.nature.com/naturecommunications (2012).

329. “Weak-acceptor-polyacrylonitrile/donor-polyaniline core–shell nanofibers: A novel 1D polymeric heterojunction with high photoconductive properties”, W. Wang, X. Lu, Z. Li, X. Li, X. Xu, J. Lei, C. Wang, R.H. Baughman, S. Fang, *Organic Electronics* **13**, 2319-2325 (2012).

330. ‘‘Hybrid Nanomembranes for High Power and High Energy Density Supercapacitors and Their Yarn Application”, J. A. Lee, M. K. Shin, S. H. Kim, S. J. Kim, G. M. Spinks, G. G. Wallace, R. Ovalle-Robles, M. D. Lima, M. E. Kozlov, and R. H. Baughman, *ACS Nano* **6**, 327-334 (2012).

331. “Catalytic Twist-Spun Yarns of Nitrogen-Doped Carbon Nanotubes”, X. Lepró, R. Ovalle-Robles, M. D. Lima, A. L. Elías, M. Terrones, R. H. Baughman, *Advanced Functional Materials* **22**, 1069-1075 (2012).

332. “Hydrogen Fuel-Powered Bell-Segments of Biomimetic Jellyfish Undersea Vehicle”, Y. Tadesse, A. Villanueva, C.S. Haines, D. M. Novitski, R. H. Baughman, and S. Priya, *Smart Materials and Structures* **21** (2012) 045013 (17pp).

333. “Terahertz surface plasmon polaritons on freestanding multi-walled carbon nanotube aerogel sheets”, T. D. Nguyen, S. Liu, M. D. Lima, S. Fang, R. H. Baughman, A. Nahata, Z. V. Vardeny, *Optical Materials Express* **2,** 782-788 (2012).

334. “Fibers of reduced graphene oxide nanoribbons”, E. Y. Jang, J. Carretero-González, A. Choi, W. J. Kim, M. E. Kozlov, T. Kim, T. J. Kang, S. J. Baek, D. W. Kim, Y. W. Park, R. H Baughman, Y. H. Kim, *Nanotechnology* **23** (2012) 235601 (8 pp.)

335. “Regulation of morphogenesis and neural differentiation of human mesenchymal stem cells using carbon nanotube sheets”, J. A. Kim, E. Y. Jang, T. J. Kang, S. Yoon, R. Ovalle-Robles, W. J. Rhee, T. Kim, R. H. Baughman, Y. H. Kim, T. H. Park, *Integrative Biology* **4**, 587-594 (2012).

336. "Electrical Stimulation of Primary Murine Myoblasts on Aligned Nanostructured Conductive Polymer Platforms", A. Quigley, J. Razal, M. Kita, R. Jalili, A. Gelmi, A. Penington, R. Ovalle-Robles, R. H. Baughman, G. Clark, G. Wallace, R. Kapsa, *Advanced Healthcare Materials* **1**, 801-808 (2012).

337. "Oriented Graphene Nanoribbon Yarn and Sheet from Aligned Multi-Walled Carbon Nanotube Sheets", J. Carretero–González, E. Castillo–Martínez, M. D. Lima, M. Acik, D. M. Rogers, J. Sovich, C. S. Haines, X. Lepró, M. Kozlov, A. A. Zhakidov, Y. Chabal, R. H. Baughman, *Advanced Materials* **24**, 5695-5701 (2012).

338. "Electromechanical Actuator with Controllable Motion, Fast Response-Rate and High Frequency Resonance Based on Graphene and Polydiacetylene", J. Liang, L. Huang, Y. Huang, Y. Wu, S. Fang, Y. Ma, F. Li, C. S. Haines, R. H. Baughman, Y. Chen, *ACS Nano* **6**, 4508-4519 (2012).

339. "Electrically, Chemically, and Photonically Powered Torsional and Tensile Actuation of Hybrid Carbon Nanotube Yarn Muscles", M. D. Lima, N. Li, M. Jung de Andrade, S. Fang, J. Oh, G. M. Spinks, M. E. Kozlov, C. S. Haines, D. Suh, J. Foroughi, S. J. Kim, Y. Chen, T. Ware, M. K. Shin, L. D. Machado, A. F. Fonseca, J. D. W. Madden, W. E. Voit, D. S. Galvão, R. H. Baughman, *Science* **338**, 928-932 (2012).

340. "Reconstructed Ribbon Edges in Thermally Reduced Graphene Nanoribbons", M. Acik, J. Carretero–González, E. Castillo–Martínez, D. M. Rogers, R. Guzman, R. H. Baughman, Y. J. Chabal, *Journal of Physical Chemistry* C **116**, 24006-24015 (2012).

341. "Carbon Nanotubes - Present and Future Commercial Applications" M. F. L. De Volder, S. H. Tawfick, R. H. Baughman, A. J. Hart, *Science* **339**, 535-539 (2013).

342. "Enhanced Power and Rechargeability of a Li-O_2 Battery Based on a Hierarchical- Fibril CNT Electrode", H.-D. Lim, K.-Y. Park, H. Song, E. Y. Jang, H. Gwon, J. Kim, Y. H. Kim, M. D. Lima, R. O. Robles, X. Lepró, R. H. Baughman, K. Kang, *Advanced Materials* **25**, 1348-1352 (2013).

343. "Niobium nanowire yarns and their application as artificial muscles", S. M. Mirvakili, A. Pazukha, W. Sikkema, C. W. Sinclair, G. M. Spinks, R. H. Baughman, J. D. W. Madden, *Advanced Materials* **23**, 4311-4316 (2013).

344. "Yarn Supercapacitors for Textiles and Microdevices by Biscrolling Conducting Polymer Templated Carbon Nanotube Sheets", J. A. Lee, M. K. Shin, S. H. Kim, H. U. Cho, G. M. Spinks, G. G. Wallace, M. D. Lima, X. Lepró, M. E. Kozlov, R. H. Baughman, S. J. Kim, *Nature Communications* | 4:1970 | DOI: 10.1038/ncomms2970| www.nature.com/naturecommunications (2013).

345. "Conductive functional biscrolled polymer and carbon nanotube yarns", S. H. Kim, H. J. Sim, M. K. Shin, A Y. Choi, Y. T. Kim, M. D. Lima, R. H. Baughman, S. J. Kim, *Royal Society of Chemistry Advances* **3**, 24028-24033 (2013).

346. "Free-standing nanocomposites with high conductivity and extensibility",

K.-Y. Chun, S. H. Kim, M. K. Shin, Y. T. Kim, G. M. Spinks, A. E. Aliev, R. H. Baughman, and S. J. Kim, *Nanotechnology* **24**, 165401 (9 pp) (2013).

347. "Increasing the efficiency of thermoacoustic carbon nanotube sound projectors", A. E. Aliev, Y. N. Gartstein, R. H. Baughman, *Nanotechnology* **24**, 235501 (11pp) (2013).

348. "Amyloidogenic Peptide/Single-Walled Carbon Nanotube Composites Based on Tau Protein-Related Peptides Derived from AcPHF6: Preparation and Dispersive Properties", E. Muñoz, A. Sreelatha, R. Garriga, R. H. Baughman, W. Goux, *Journal of Physical Chemistry B*, **117**, 7593-7604 (2013).

349. "A new catalyst-embedded hierarchical air-electrode for high performance Li-O_2 batteries", H.-D. Lim, H. Song, H. Gwon, K.-Y. Park, J. Kim, Y. Bae, H. Kim, T. Kim, Y. H. Kim, R. Ovalle-Robles, X. Lepró, R. H. Baughman, and K. Kang, *Energy and Environmental Science* **6**, 3570-3575 (2013).

350. "Carbon Nanotube - Reduced Graphene Oxide Composites for Thermal Energy Harvesting Applications", M. S. Romano, N. Li, D. Antiohos, J. M. Razal, A. Nattestad, S. Beirne, S. Fang, Y. Chen, R. Jalili, G. G. Wallace, R. H. Baughman, and J. Chen, *Advanced Materials* **25**, 6602-6606 (2013).

351. "Protic ionic liquid-based thermoelectrochemical cells for the harvesting of waste heat", T. J. Abraham, D. R. MacFarlane, R. H. Baughman, Na Li, Y. Chen, and J. M. Pringle, *Mater. Res. Soc. Symp. Proc.* Vol. 1575 © 2013 Materials Research Society, DOI: 10.1557/opl.2013. 647

352. "Towards ionic liquid-based thermoelectrochemical cells for the harvesting of thermal energy", T. J. Abraham, D. R. MacFarlane, R. H. Baughman, L. Jin, Na Li, J. M. Pringle, *Electrochimica Acta* **113** 87– 93 (2013).

353. "Ultrafast charge and discharge biscrolled yarn supercapacitors for textiles and microdevices", J.A. Lee, M.K. Shin, S.H. Kim, H.U. Cho, G. M. Spinks, G. G. Wallace, M. D. Lima, X. Lepro, M. E. Kozlov, R. H. Baughman, S. J. Kim, *Nature Communications* | 4:1970 | DOI: 10.1038/ncomms2970 |www.nature.com/naturecommunications (2013).

354. "Artificial Muscles from Fishing Line and Sewing Thread", C. S. Haines, M. D. Lima, Na Li, G. M. Spinks, J. Foroughi, J. D. W. Madden, S. H. Kim, S. Fang, M. J. de Andrade, F. Göktepe, Ö. Göktepe, S. M. Mirvakili, S. Naficy, X. Lepró, J. Oh, M. E. Kozlov, S. J. Kim, X. Xu, B. J. Swedlove, G. G. Wallace, R. H. Baughman, *Science* **343**, 868-872 (2014).

355. "Hybrid carbon nanotube yarn artificial muscle inspired by spider silk dragline", K.-Y. Chun, S. H. Kim, J. Park, M. K. Shin, C. H. Kwon, Y. T. Kim, G. M. Spinks, R. H. Baughman, S. J. Kim, *Nature Communications* | 5:3322 | DOI: 10.1038/ncomms4322| www.nature.com/naturecommunications (2014).

356. "Flexible Supercapacitor Made of Carbon Nanotube Yarn with Internal Pores",

C. Choi , J. A. Lee , A. Y. Choi , Y. T. Kim , X. Lepró, M. D. Lima , R. H. Baughman , S. J. Kim , *Advanced Materials* **26**, 2059-2065 (2014).

357. "Superior Rechargeability and Efficiency of Lithium-Oxygen Batteries: Hierarchical Air-electrode Architecture Combined with a Soluble Catalyst", H.-D. Lim, H. Song, J. Kim, H. Kim, T. Kim, Y. H. Kim, X. Lepró, R. Ovalle-Robles, R. H. Baughman, K. Kang, *Angewandte Chemie, Int. Ed.* **53**, 3926-3931 (2014).

358. "High Power Biofuel Cell Textiles from Woven Biscrolled Carbon Nanotube Yarns", C. H. Kwon, S.-H. Lee, Y.-B. Choi, J. A. Lee, S. H. Kim, H.-H. Kim, G. M. Spinks, G. G. Wallace, M. D. Lima, M. E. Kozlov, R. H. Baughman, S. J. Kim, *Nature Communications* | 5:3928 | DOI: 10.1038/ncomms4928 |www.nature.com/naturecommunications (2014).

359. "All Solid State Carbon Nanotube Torsional and Tensile Artificial Muscles", J. A. Lee, Y. T. Kim, G. M. Spinks, D. Suh, X. Lepró, M. D. Lima, R. H. Baughman and S. J. Kim, *Nano Letters* **14**, 2664-2669 (2014).

360. "Automated quantification of neurite outgrowth orientation distributions on patterned surfaces", M. Payne, D. Wang, C. M. Sinclair, R. M. I. Kapsa, A. F. Quigley, G. G. Wallace, J. M. Razal, R. H. Baughman, G. Műnch, P. Vallotton, *Journal of Neural Engineering* **11**, 046006 (2014).

361. "Primary Liver Cells Cultured on Carbon Nanotube Substrates for Liver Tissue Engineering and Drug Discovery Applications", Abdullah Che, Azurahanim Che; Chihye Lewis Azad, Raquel Ovalle-Robles, Shaoli Fang, Márcio Lima , Javier L. Lepró, Steve Collins, Ray H. Baughman, Alan Dalton, Nick Plant, Richard Sear, *ACS Applied Materials & Interfaces* **6**, 10373-10380 (2014).

362. "Highly Conductive Carbon Nanotube-Graphene Hybrid Yarn" , J. Foroughi G. M. Spinks, D. Antiohos, S. Gambhir, G. G. Wallace, S. R. Ghorbani, G. Peleckis, M. E. Kozlov, M. D. Lima, R. H. Baughman, A*dvanced Functional Materials*, **24**, 5859-5865 (2014).

363. "Thermoacoustic excitation of sonar projector plates by free-standing carbon nanotube sheets", A. E. Aliev, N. K. Mayo, R. H. Baughman, D. Avirovik, S. Priya, M. R. Zarnetske, J. B. Blottman, *J. Phys. D: Appl. Phys.* **47**, 355302 (9 pp) (2014).

364. "Simple and strong: Twisted silver painted nylon artificial muscle actuated by Joule heating", S. M. Mirvakili, A. R. Ravandia, I. W. Hunter, C. S. Haines, Na Li, J. Foroughi, S. Naficy, G. M. Spinks, R. H. Baughman, J. D. W. Madden, Proc. SPIE 9056, Electroactive Polymer Actuators and Devices 2014, 90560I; doi: 10.1117/12.2046411 (March 2014).

365. "Thermal Management of Thermoacoustic Sound Projectors Using a Free-Standing Carbon Nanotube Aerogel Sheet as Heat Source", A. E. Aliev, N. K.

Mayo, R. H. Baughman, D. Avirovik, S. Priya, M. R. Zarnetske, J. B. Blottman, *Nanotechnology* **25**, 405704 (2014).

366. "Nanotube Aerogel Sheet Flutter for Actuation, Power Generation, and Infrasound Detection", T. J. Kang, T. Kim, E. Yun Jang, H. Im, X. Lepro-Chavez, R. Ovalle-Robles, J. Oh, M. E. Kozlov, R. H. Baughman, H. H. Lee, Y. H. Kim, *Scientific Reports* **4**, 6105; DOI:10.1038/srep06105 (2014).

367. "Flexible, Ultralight, Porous Superconducting Yarns Containing Shell-Core Magnesium Diboride-Carbon Nanotube Nanofibers", J. S. Bykova, M. D. Lima, C. S. Haines, D. Tolly, M. B. Salamon, R. H. Baughman, A. A. Zakhidov, *Advanced Materials* **26**, 7510-7515 (2014).

368. "Advancements toward a high-power, carbon nanotube, thin-film loudspeaker A. R. Barnard, T. A. Brungart, T. E. McDevitt, A. E. Aliev, D. M. Jenkins, B. L. Kline, R. H. Baughman, *Noise Control Engr.* **62**, 360-367 (2014).

369. "Three-dimensionally bonded spongy graphene material with super compressive elasticity and near-zero Poisson's ratio", Y. Wu, N. Yi, L. Huang, T. Zhang, S. Fang, H. Chang, Na Li, J. Oh, J. A. Lee, M. Kozlov, A. C. Chipara, H. Terrones, P. Xiao, G. Long, Y. Huang, F. Zhang, L. Zhang, X. Lepr, C. Haines, M. D. Lima, N. P. Lopez, L. P. Rajukumar, A. L. Elias, S. Feng, S. J. Kim, N. T. Narayanan, P. M. Ajayan, M. Terrones, A. Aliev, R. H. Baughman, Y. Chen, *Nature Communications*, 6:6141 doi: 10.1038/ncomms7141 (2015).

370. "Torsional Behaviors of Polymer-infiltrated Carbon Nanotube Yarn Muscles by Atomic Force Microscope", C. H. Kwon, K. Chun, S. H. Kim, J. Lee, J. Kim, M. D. Lima, R. H. Baughman and S. J. Kim, *Nanoscale* **7**, 2489-2496 (2015).

371. "Flexible, Stretchable and Weavable Piezoelectric Fiber", H. J. Sim, C. ChoiC. J. Lee, Y. T. Kim, G. M. Spinks, M. D. Lima, R. H. Baughman and S. J. Kim, *Advanced Engineering Materials* **17**, 1270-1275 (2015).

372. "Stability of carbon nanotube yarn biofuel cell in human body fluid", C. H. Kwon, J. A. Lee, Y.-B. Choi, H.-H. Kim, G. M. Spinks, M. D. Lima, R. H. Baughman, S. J. Kim, *Journal of Power Sources* **286**, 103-108 (2015).

373. "Stretchable, Weavable Coiled Carbon Nanotube/MnO_2/Polymer Fiber Solid-State Supercapacitors", C. Choi, S. H. Kim, H. J. Sim, J. A. Lee, A Y. Choi, Y. T. Kim, X. Lepro, G. M. Spinks, R. H. Baughman, S. J. Kim, *Scientific Reports* | 5 : 9387 | DOI: 10.1038/srep09387.

374. "High performance electrochemical and electrothermal artificial muscles from twist-spun carbon nanotube yarn", J. A. Lee, R. H Baughman and S. J. Kim, *Nano Convergence* 2015, **2**:8 doi:10.1186/s40580-014-0036-0.

375. "Nylon-muscle-actuated robotic finger", L. Wu, M. Jung de Andrade, R. S. Rome, C. Haines, M. D. Lima, R. H. Baughman, Y. Tadesse, *Proc. SPIE* 9431, Active

and Passive Smart Structures and Integrated Systems 2015, 94310I (April 2, 2015); doi:10.1117/12.2084902.

376. “Efficient, Absorption-Powered Artificial Muscles Based on Carbon Nanotube Hybrid Yarns”, M. D. Lima, W. Hussain, G. M. Spinks, S. Naficy, D. Hagensash, J. S. Bykova, D. Tolly, and R. H. Baughman, *Small* **11**, 3113-3118 (2015).

377. “Alternative Nanostructures for Thermophones”, A. E. Aliev, N. K. Mayo, M. J. de Andrade, R. O. Robles, S. Fang, R. H. Baughman, M. Zhang, Y. Chen, J. A. Lee, S. J. Kim, *ACS Nano* **9**, 4743-4756 (2015).

378. "Optical, electrical, and electromechanical properties of hybrid graphene/carbon nanotube films", I. N. Kholmanov, C. W. Magnuson, R. Piner, J.-Y. Kim, A. E. Aliev, C. Tan, T. Y. Kim, A. A. Zakhidov, G. Sberveglieri, R. H. Baughman, R. S. Ruoff, *Advanced Materials* **27**, 3053-3059 (2015).

379. "Three-dimensionally Ordered Macro-/Mesoporous Ni as a Highly Efficient Electrocatalyst for Hydrogen Evolution Reaction", T. Sun, C. Zhang, J. Chen, Y. Yan, A. A. Zakhidov, R. H. Baughman, L. Xu, *Journal of Materials Chemistry* A, *Journal of Materials Chemistry A* **3**, 11367-11373 (2015).

380. “Hierarchically buckled sheath-core fibers for superelastic electronics, sensors, and muscles”, Z. F. Liu, S. Fang, F. A. Moura, J. N. Ding, N. Jiang, J. Di, M. Zhang, X. Lepró, D. S. Galvão, C. S. Haines, N. Y. Yuan, S. G. Yin, D. W. Lee, R. Wang, H. Y. Wang, W. Lv, C. Dong, R. C. Zhang, M. J. Chen, Q. Yin, Y. T. Chong, R. Zhang, X. Wang, M. D. Lima, R. Ovalle-Robles, D. Qian, H. Lu, R. H. Baughman, *Science* **349**, 400-404 (2015).

381. “Harvesting temperature fluctuations as electrical energy using torsional and tensile polymer muscles”, S. H. Kim, M. D. Lima, M. E. Kozlov, C. S. Haines, G. M. Spinks, S. Aziz, C. Choi, H. J. Sim, X. Wang, H. Lu, D. Qian, J. D. W. Madden, R. H. Baughman and S. J. Kim, *Energy & Environmental Science* **8**, 3336-3344 (2015).

382. "Straining to expand entanglements”, R. H. Baughman and A. F. Fonseca, *Nature Materials* **15**, 7-8 (2016).

383. “Bio-Inspired Polymer Artificial Muscles”, S. Naficy, G. M Spinks, R. H. Baughman, Chapter 13, pp. 429-459, *Bioinspired Polymers*, Editors N. Bruns and A. F. M. Kilbinger, RSC Polymer Chemistry Series (2016).

384. “High-efficiency electrochemical thermal energy harvester using carbon nanotube aerogel sheet electrodes”, H. Im, T. Kim, H. Song, J. Choi, J. S. Park, R. Ovalle-Robles, H. D. Yang, K. D. Kihm, R. H. Baughman, H. H. Lee, T. J. Kang, and Y. H. Kim, *Nature Communications*, 7:10600 doi: 10.1038/ncomms10600 (2016).

385. "Elastomeric and Dynamic MnO_2/CNT Core-Shell Structure Coiled Yarn Supercapacitor", C. Choi, H. J. Sim; G. M. Spinks, X. Lepró; R. H. Baughman, S. J. Kim, *Advanced Energy Materials* (on-line version published in 2016,

http://dx.doi.org/10.1002/aenm.201502119, print version in press, selected as a cover for hard cover version.

386. “Biothermal sensing of a torsional artificial muscle”, S.-H. Lee, T. H. Kim, M. D. Lima, R. H. Baughman, and S. J. Kim, *Nanoscale* **8**, 3248-3253 (2016).

387. “Highly stretchable hybrid nanomembrane supercapacitor”, K. J. Kim, J. A. Lee, M. D. Lima, R. H. Baughman, S. J. Kim, *Royal Society of Chemistry Advances* **6**, 24756-24759 (2016).

388. “Carbon Nanotube Yarn-Based Glucose Sensing Artificial Muscle”, J. Lee, S. Ko, C. H. Kwon, M. D. Lima, R. H. Baughman, S. J. Kim, *Small* **12**, 2085-2091 (2016), selected as a cover for hard cover version.

389. “Ordered Mesoporous Nickel Sphere Arrays for Highly Efficient Electrocatalytic Water Oxidation", T. Sun, L. Xu, Y. Yan, A. A. Zakhidov, R. H. Baughman, J. Chen, *ACS Catalysis* **6**, 1446-1450 (2016).

390. “Mediator-free Carbon Nanotube Yarn Biofuel Cell”, C. H. Kwon, Y. B. Park, J. A. Lee, Y. B. Choi, H. H. Kim, M. D. Lima, R. H. Baughman, S. J. Kim, *Royal Society of Chemistry Advances* **6**, 48346-48350 (2016).

391. “Tensile actuators of carbon nanotube coiled yarn based on polydiacetylene-pluronic copolymers as temperature indicators”, H. U. Lee, H. Kim, K. Y. Chun, C. H. Kwon, M. D. Lima, R. H. Baughman, S. J. Kim, *Smart Materials and Structures* |25:075021| DOI:10.1088/0964-1726/25/7/075021.

392. “Bio-inspired Hybrid Carbon Nanotube Muscles”, T. H. Kim, C. H. Kwon, C. Lee, J. An, T. T. T. Phuong, S. H. Park, M. D. Lima, R. H. Baughman, T. M. Kang, S. J. Kim, *Scientific Reports* | 6 : 26687 | DOI: 10.1038/srep26687.

393. “Ultraviolet-induced irreversible tensile actuation of diacetylene/nylon microfibers”, K. Y. Chun, C. Choi, R. H. Baughman, S. J. Kim, *Smart Materials and Structures* | 25 : 075031 | DOI:10.1088/0964-1726/25/7/075031.

394. “Bio-inspired, Moisture-Powered Hybrid Carbon Nanotube Yarn”, S. H. Kim, C. H. Kwon, K. Park, T. J. Mun, X. Lepró, R. H. Baughman, G. M. Spinks, and S. J. Kim, *Scientific Reports* **6**, 23016; doi: 10.1038/srep23016 (2016).

395. “Woven yarn thermoelectric textiles”, J. A. Lee, A. E. Aliev, J. S. Bykova, M. J. de Andrade, D. Kim, H. J. Sim, X. Lepró, A. A. Zakhidov, J.-B. Lee, G. M. Spinks, S. J. Kim, and R. H. Baughman, *Advanced Materials* **28**, 5038-5044 (2016).

396. “Temperature-Responsive Tensile Actuator Based on Multi-walled Carbon Nanotube Yarn”, H. Kim, J. A. Lee, H. J. Sim, M. D. Lima, R. H. Baughman, S. J. Kim, *Nano-Micro Letters* **8**, 254-259 (2016).

397. “Downsized Sheath-Core Conducting Fibers for Weavable Superelastic Wires, Biosensors, Supercapacitors and Strain Sensors”, H. Wang, Z. Liu, X. Lepró, S. Fang, N. Jiang, R. Wang, Q. Yin, W. Lv, Z. Liu, M. Zhang, R. Ovalle-Robles, K. Inoue, S. Yin, and R. H. Baughman, *Advanced Materials* **28**, 4998-5007 (2016). (Chosen as inside front cover.)

398. ‘‘A deformable robot with tensegrity structure using nylon artificial muscle”, L. Wu, Monica J. de Andrade, T. Brahm, Y. Tadesse and R. H. Baughman, Proceedings of the Active and Passive Smart Structures and Integrated Systems Conference (2016). http://dx.doi.org/10.1117/12.2219641.

399. “Strong, twist-stable carbon nanotube yarns and muscles by tension annealing at extreme temperatures”, J. Di, S. Fang, F. A. Moura, D. S. Galvão, J. Bykova, A. E. Aliev, M. Jung de Andrade, X. Lepró, N. Li, C. S. Haines, R. Ovalle-Robles, D. Qian, and R. H. Baughman, *Advanced Materials* **28**, 6598–6605 (2016).

400. “Brazing techniques for the fabrication of biocompatible carbon-based electronic devices”, N.V. Apollo, D. Lau, A. Ahnood, A. Stacey, K. Ganesan, S.G. Lichter, K. Fox, J. Foroughi, H. Meffin, G.G. Wallace, R. H. Baughman, S. Prawer, D. J. Garrett, *Carbon* **106**, 180-189 (2016).

401. “Ultraviolet-Induced Irreversible Tensile Actuation of Diacetylene/Nylon Microfibers", K.-Y. Chun, C. Choi, R. H. Baughman, S. J. Kim, *Smart Materials and Structures* **25** (2016) 075031 (7pp).

402. “Electrothermally Driven Carbon-Based Materials as EAPs: Fundamentals and Device Configurations”, J. Foroughi, G. M. Spinks, J. D. Madden, R. H. Baughman, S. J. Kim, Chapter 1, pp. 1-6, in F. Carpi (ed.), *Electromechanically Active Polymers, Polymers and Polymeric Composites: A Reference Series* (Springer International Publishing, 2016).

403. “Electrochemically Driven Carbon-Based Materials as EAPs: Fundamentals and Device Configurations”. J. Torop, A-L. Peikolainen, A. Aabloo, M. Koel, K. Asaka, and R. H. Baughman, Chapter 18, pp. 439-454 in F. Carpi (ed.), *Electromechanically Active Polymers, Polymers and Polymeric Composites: A Reference Series* (Springer International Publishing, 2016).

404. “New Twist on Artificial Muscles”, C. S. Haines, Na Li, G. M. Spinks, A. E. Aliev, J. Dia, R. H. Baughman, *Proceedings National Academy of Sciences* **113**, 11709-11716 (2016), Selected as journal front cover.

405. “Knitted Carbon-Nanotube-Sheath/Spandex-Core Elastomeric Yarns for Artificial Muscles and Strain Sensing”, J. Foroughi, G. M. Spinks, S. Aziz, A. Mirabedinin, A. Jeiranikhameneh, G. G. Wallace, R. H. Baughman, M. E. Kozlov, *ACS Nano* **10**, 9129-9135 (2016).

406. “Bioinspired Multifunctional Ceramic Platelet-Reinforced Piezoelectric Polymer Composite", Z. Xu, J. Bykova, M. Baniasadi, S. Morenor, Z. Zhou, N. Das, S.

Bandi, Y. Xi, D. Qian, R. H. Baughman, M. Minary-Jolandan, *Advanced Engineering Materials,* Published Online Sept. 2016).

407. "Microscopically Buckled and Macroscopically Coiled Fibers for Ultra-Stretchable Supercapacitors, C. Choi , J. H. Kim , H. J. Sim , J. Di , R. H. Baughman, S. J. Kim, *Advanced Energy Materials*, 1602021 (2016, 7 pages).

408. "Stretchable Triboelectric Fiber for Self-powered Kinematic Sensing Textile", H. J. Sim, C. Choi, S. H. Kim, K. M. Kim, C. J. Lee, Y. T. Kim, X. Lepro, R. H. Baughman, S. J. Kim, *Scientific Reports*, 6:35153 (October 2016).

409. "Twistable and Stretchable Sandwich Structured Fiber for Wearable Sensors and Supercapacitors", C. Choi, J. M. Lee, S. H. Kim, S.J. Kim, J. Di, R. H. Baughman, *ACS Nano Letters*, DOI:10.1021/acs.nanolett.6b03739 (Published Online Nov. 2016).

410. "Improvement of System Capacitance via Weavable Superelastic Biscrolled Yarn Supercapacitors", C. Choi, K. Min Kim, K. J. Kim, Xavier Lepró, G. M. Spinks, R. H. Baughman, S. J. Kim, *Nature Communications*, DOI: 10.1038/ncomms138111, accepted Nov. 2, 2016.

411. "Magnetic Torsional Actuation of a Carbon Nanotube Yarn Artificial Muscle", W. W. Lee, S. H. Kim, M. E. Kozlov, X. Lepró, R. H. Baughman, S. J. Kim, *Smart Materials and Structures*, accepted 2016.

412. "Compact and Low-Cost Humanoid Hand Powered by Nylon Artificial Muscles", W. Lianjun; M. Jung de Andrade; L. Saharan; R. Rome; R. H. Baughman; Y. Tadesse, *Bioinspiration & Biomimetics*, accepted 2016.

ISSUED UNITED STATES PATENTS

1. "Cyclically-Bound Ladder Polymers of Cyclic Diacetylene Tetramers", R.H. Baughman and K.C. Yee, U.S. 3,923,622.

2. "Organic Polymers with Near-Zero Uniaxial Thermal Expansion Coefficients", R.H. Baughman, E.A. Turi, A.F. Preziosi, and K.C. Yee, U.S. 3,994,867.

3. "Time-Temperature History Indicators", G.N. Patel, A.F. Preziosi, and R.H. Baughman, U.S. 3,999,946.

4. "Carbazolyl Diacetylenic Polymers", K.C. Yee, R.R. Chance, and R.H. Baughman, U.S. 4,208,501.

5. "Thermochromic Polydiacetylenes Containing Urethane Groups", R.H. Baughman, R.R. Chance, G.G. Miller, G. Patel, A.F. Preziosi, and K.C. Yee, U.S. 4,215,208.

6. "Crystalline Diacetylene Polymers", R.H. Baughman, A.F. Preziosi, and K.C. Yee, U.S. 4,220,747.

7. “Thermochromic Polydiacetylenes”, K.C. Yee, A.F. Preziosi, G.N. Patel, R.R. Chance, G.G. Miller and R.H. Baughman, U.S. 4,242,440.

8. “Organic Polymers with Near-Zero Uniaxial Thermal Expansion Coefficients” R.H. Baughman, E.A. Turi, A.F. Preziosi, and K.C. Yee, U.S. 3,994,867 (Divisional of 4,255,535).

9. “Process of Printing by Impact and For Making Areas Where Impact or Pressure is Applied”, R.H. Baughman and G.N. Patel, U.S. 4,328,259.

10. “Temperature Measurement and Display of Indicia Using Thermochromic Polyacetylenes”, K.C. Yee, A.F. Preziosi, G.N. Patel, R.R. Chance, G.G. Miller, and R.H. Baughman, U.S. 4,339,951.

11. “Metal Salts of Polyacetylenic Compounds and Uses Thereof As Ion Exchange and Thermochromic Polymers”, A.F. Preziosi, G.N. Patel, R.G. Denkewalter, and R.H. Baughman, U.S. 4,373,032.

12. “Thermoplastic Conductive Polymers”, G.G. Miller, D.M. Ivory, L.W. Shacklette, R.R. Chance, R.L. Elsenbaumer, R.H. Baughman, U.S. 4,375,427.

13. “Integrated Time-Temperature and Radiation Dosage History Recording Device”, R.H. Baughman, G.G. Miller, and G.N. Patel, U.S. 4,389,217.

14. “Electrically Conductive Compositions of Doped Polyphenylenes and Shaped Articles Comprising the Same”, D.M. Ivory, G.G. Miller, R.R. Chance, and R.H. Baughman, U.S. 4,440,669.

15. “Battery Having Polymeric Anode Coated with Reaction Product of Oxirane Compound”, M. Maxfield, G.G. Miller, R.H. Baughman, and J.E. Frommer, U.S 4,472,487.

16. “Enhancing Conductivity of Donor-Doped Polyacetylene”, P.G. Delannoy, G.G. Miller, H. Eckhardt, and R.H. Baughman, U.S. 4,502,981.

17. “Electrically Conductive Compositions of Doped Polyphenylenes and Shaped Articles Comprising the Same”, D.M. Ivory, G.G. Miller, R.R. Chance, and R.H. Baughman, U.S. 4,517,116.

18. “Environmental Indicator Device and Method”, R.H. Baughman, R.L. Elsenbaumer, Z. Iqbal, G.G. Miller, and H. Eckhardt, U.S. 4,646,066.

19. “Indicator Device Using Metal Salts of Polyacetylenic Compounds”, A.F. Preziosi, G.N. Patel, R.G. Denkewalter, and R.H. Baughman, U.S. 4,646,674.

20. “Method for Grafting Polymers to Polytetrafluoroethylene, and Grafted Composites Thereof”, R.L. Elsenbaumer, D.M. Ivory, Z. Iqbal, and R. H. Baughman, U.S. 4,661,383.

21. “Metal Salts of Polyacetylenic Compounds and Uses Thereof”, A.F. Preziosi, G. N. Patel, R.G. Denkewalter, and R.H. Baughman, U.S. 4,699,997.

22. “Defrost Indicator for Detecting Handling Abuse of Frozen Foods”, A.F. Peziosi, T. Prusik, and R.H. Baughman, U.S. 4,735,745.

23. “Dual-Pane Thermal Window With Liquid Crystal Shade”, R.H. Baughman, E.D. Buff, H. Eckhardt, and G.H. Fuchs, U.S. 4,848,875.

24. “Method of Forming Superconducting Ceramics by Electrodeposition”, M. Maxfield, R. H. Baughman, Z. Iqbal and H. Eckhardt, U.S. 4,870,051.

25. “Method of Forming Superconducting Ceramics by Electrodeposition”, M. Maxfield, R.H. Baughman, Z. Iqbal, and H. Eckhardt, U.S. 4,879,270.

26. “Defrost Indicator”, A.F. Preziosi, T. Prusik, R.H. Baughman, U.S. 4,892,677.

27. “Adjustable Tint Window With Electroactive Conductive Polymers”, J.F. Wolf, L.W. Shacklette, G.G. Miller, R.L. Elsenbaumer, and R.H. Baughman, U.S. 4,893,908.

28. “Dual-Pane Thermal Window With Liquid Crystal Shade”, R.H. Baughman, E.D. Buff, H. Eckhardt, and G.H. Fuchs, U.S. 4,893,902.

29. Division of above, U.S. 4,899,503.

30. “Methods of Forming Crystallite-Oriented Superconducting Ceramics by Electrodeposition”, M. Maxfield, R.H. Baughman, Z. Iqbal, and H. Eckhardt, U.S. 4,939,308.

31. “Method of Making a Thermal Window Glazing with Conductive Polymer Coating to Block Radiative Heating”, L.W. Shacklette, K. Jen, H. Eckhardt, R.L. Elsenbaumer, and R.H. Baughman, U.S. 4,963,206.

32. “Dual Pane Thermal Window with Liquid Crystal Shade”, R.H. Baughman, E.D. Buff, H. Eckhardt, and G.H. Fuchs, U.S. 4,964,251.

33. U.S. 5,009,044 (Divisional of above).

34. U.S. 5,025,602 (Divisional of above).

35. “Adjustable Tint Window with Electrochromic Conductive Polymer”, J.F. Wolf, G.G. Miller, L.W. Shacklette, R.L. Elsenbaumer, and, R.H. Baughman, U.S. 5,042,923.

36. “Thermal Window Glazing with Conductive Polymer Coating to Block Radiative Heating”, L.W. Shacklette, K. Jen, H. Eckhardt, R.L. Elsenbaumer, and R.H Baughman, U.S. 5,099,621.

37. “Dual, Series/Parallel Battery Cell Connects”, R.H. Baughman, C. Becht, and L.W. Shacklette, U.S. 5,104,752.

38. “Dual Pane Thermal Window with Liquid Crystal Shade”, R.H. Baughman, E.D. Buff, H. Eckhardt, and G.H. Fuchs, U.S. 5,152,111.

39. “Superconducting Ceramics by Electrodeposition of Metals with Embedment of Particulate Matter Followed by Oxidation”, M. Maxfield, H. Eckhardt, R. H. Baughman, and Z. Iqbal, U.S. 5,120,707.

40. “Dual Pane Thermal Window With Liquid Crystal Shade”, R.H. Baughman, E.D. Buff, H. Eckhardt, and G.H. Fuchs, U.S. 5,152,111.

41. “Superconducting Ceramics by Sequential Electrodeposition of Metals Followed by Oxidation”, R.H. Baughman, M. Behi, H. Eckhardt, Z. Iqbal, and M. Maxfield, U.S. 5,162,295.

42. “Dual Pane Thermal Window with Liquid Crystal Shade”, R.H. Baughman, E.D. Buff, H. Eckhardt, and G.H. Fuchs, U.S. 5,197,242.

43. “Conducting Polymer Film Formation Using Initiator Pretreatment”, C.C. Han, R.H. Baughman, and R.L. Elsenbaumer, U.S. 5,225,495.

44. “Piezoelectric Ceramic-Polymer Composites”, C. Cui, R.H. Baughman, Z. Iqbal, T.R. Kazmar, and D.K. Dahlstrom, U.S. 5,702,629.

45. “Improved Colored Articles and Compositions and Methods for Their Fabrication”, T.L. Smith, R.H. Baughman, M.F. Martin, W. Choi, and J. Moulton, U.S. 5,932,309.

46. “Piezoelectrics and Related Devices from Ceramics Dispersed in Polymers”, C. Cui, R.H. Baughman, Z. Iqbal, T.R. Kazmar, and D.K. Dahlstrom, U.S. 5,951,908.

47. U.S. Patent 6,074,742 (Divisional of US 5,932,309).

48. “Method for the Mechanochemical Preparation of High Performance Ceramics”, C. Cui, J. Su, and R.H. Baughman, U.S. 6,136,229.

49. U.S. 6,150,019 (Divisional of US 5,932,309).

50. U.S. 6,153,299 (Divisional of US 5,932,309).

51. “Three Dimensionally Periodic Structural Assemblies on Nanometer and Longer Scales”, A.A. Zakhidov, R.H. Baughman, C. Cui, I. Khayrullin, L.-M. Liu, I. Udod, J. Su, and M. Kozlov, U.S. 6,261,469.

52. “Colored Articles and Compositions and Methods for Their Fabrication”, T.L. Smith, R.H. Baughman, M.F. Martin, W. Choi, and J. Moulton, U.S. 6,440,340.

53. “Colored Articles and Compositions and Methods for Their Fabrication”, T.L. Smith, R.H. Baughman, M.F. Martin, W. Choi, and J. Moulton, U.S. 6,514,446.

54. “Actuators Using Double-Layer Charging of High Surface Area Materials”, R.H. Baughman, C. Cui, J. Su; Z. Iqbal; A.A. Zakhidov, U.S. 6,555,945.

55. “Spinning, Processing, and Applications of Carbon Nanotube Filaments, Ribbons, and Yarns”, A. Lobovsky, J. Matrunich, M. Kozlov, R.C. Morris, R.H. Baughman, A.A. Zakhidov, U.S. 6,682,677.

56. “Composite Material Comprising Oriented Carbon Nanotubes in a Carbon Matrix and Process for Preparing Same”, A. Lobovsky, J. Matrunich, R.H. Baughman, I. Palley, G.A. West, I. Golecki, U.S. 6,764,628.

57. “Spinning, Processing, and Applications of Carbon Nanotube Filaments, Ribbons, and Yarns”, A. Lobovsky, J. Matrunich, M. Kozlov, R.C. Morris, R.H. Baughman, A.A. Zakhidov, U.S. 7,247,290.

58. “Method and apparatus for transferring an array of oriented carbon nanotubes”, A. A. Zakhidov, R. Nanjundaswamy, S. Li, A. Zakhidov, M. Zhang, R. H. Baughman, U.S. 7,718,230 B2 (issued May 18, 2010).

59. “Material and Device Properties Modification by Electrochemical Charge Injection in the Absence of Contacting Electrolyte for either Local Spatial or Final States”, D.-S. Suh, R.H. Baughman, A. A. Zakhidov, US 7,897,030 B2 (issued March 1, 2011, expires April 14, 2028).

60. “Polymer-free Carbon Nanotube Assemblies (Fibers, Ropes, Ribbons, Films)”, R. H. Baughman, M. Kozlov, V. H. Ebron, R. Capps, J. Ferraris, US 7,938,996 (Issued May 10, 2011).

61. “Material and Device Properties Modification by Electrochemical Charge Injection in the Absence of Contacting Electrolyte for either Local Spatial or Final States”, D.-S. Suh, R.H. Baughman, A. A. Zakhidov, US 8,021,524 B2 (issued Sept. 20, 2011). *This is a divisional of the same filing as the above patent 60.*

62. “Material and Device Properties Modification by Electrochemical Charge Injection in the Absence of Contacting Electrolyte for either Local Spatial or Final States”, D.-S. Suh, R.H. Baughman, A. A. Zakhidov, US 8,066,855 B2 (issued Nov. 29, 2011). *This is a divisional of the same filing as the above patent 60 and 62.*

63. **“**Adjuvant-mediated reactivity enhancement of polymerizable polyacetylenic materials for indicator inks”, T. Prusik, D. Smith, R. H. Baughman, US 8,067,483 (Nov. 29, 2011).

64. “Material and Device Properties Modification by Electrochemical Charge Injection in the Absence of Contacting Electrolyte for either Local Spatial or Final States”,

D.-S. Suh, R.H. Baughman, A. A. Zakhidov, US 8,080,149 B2 (issued Dec. 20, 2011). *This is a divisional of the same filing as the above patent 60, 62, and 63.*

65. "Material and Device Properties Modification by Electrochemical Charge Injection in the Absence of Contacting Electrolyte for either Local Spatial or Final States", D.-S. Suh, R.H. Baughman, A. A. Zakhidov, US 8,083,909 B2 (issued Dec. 27, 2011). *This is a divisional of the same filing as the above patents 60, 62, 63, and 65..*

66. "Fuel Powered Actuators and Methods of Using Same", R. H. Baughman, V. H. Ebron, Z. Yang, D. J. Seyer, M. Kozlov, J. Oh, H. Xie, J. Razal, J. P. Ferraris, A. G. MacDiarmid, W. A. Macaulay, US 8,096,119 B2 (Issued 1/17/2012).

67. "Material and Device Properties Modification by Electrochemical Charge Injection in the Absence of Contacting Electrolyte for either Local Spatial or Final States", D.-S. Suh, R.H. Baughman, A. A. Zakhidov, US 8,101,061 B2 (issued Jan. 24, 2012). *This is a divisional of the same filing as the above patents 60, 62, 63, 65, and 66.*

68. "Diameter-selective reversible closable peptides", G. R. Dieckmann, A. Ortiz-Acevedo, R. H. Baughman, A. B. Dalton, R. K. Draper, and I. H. Musselman,. US 8,198,403 B2 (Issued June 12, 2012).

69. "Crystallized diacetylenic indicator compounds and methods of preparing the compounds", R. H. Baughman, L. J. Hall, M. Kozlov, D. E. Smith, T. Prusik, US 8,269,042 B2 (issued Sept. 18, 2012).

70. "Co-crystallizable diacetylenic monomer compositions, crystal phases and mixtures, and related methods", E. C. Marttinez, R. H. Baughman, L. J. Hall, M. Kozlov, D. E. Smith, T. Prusik, and C. M. Lentz, US 8,354,489 B2 (issued Jan. 15, 2013).

71. "Process for preparing an indicator composition and indicator compositions", T. Prusik, D. Smith, and R H. Baughman, US 8,529,682 B2 (issued Sept. 10, 2013) This is a divisional of the same filing as for US 8,067,482).

72. "Crystallized diacetylenic indicator compounds and methods of preparing the compounds", R. H. Baughman, L. J. Hall, M. Kozlov, D. E. Smith, T. Prusik, US 8,642,807 B2 (issued Feb. 4, 2014). This is a divisional of the same filing as for US 8,269,042).

73. "Time-temperature indicators comprising crystallized diacetylenic indicator compounds", R. H. Baughman, L. J. Hall, M. Kozlov, D. E. Smith, T. Prusik, US 8,813,675 B2 (issued Aug. 26, 2014). This is a divisional of the same filing as for US 8,269,042 and US 8,642,807).

74. “Fabrication of twisted and non-twisted nanofiber yarns”, M. Zhang, R.H. Baughman, K. R. Atkinson, US 8,926,933 (Issued Jan. 6, 2015).

75. “Fabrication of biscrolled fiber using carbon nanotube sheet”, S. Fang, M. D. Lima, X. N. Lepro-Chavez, J. Carretero-Gonzalez, E. Castillo-Martinez, R. Ovalle-Robles, C. S. Haines, D. M. Novitski, M. H. Haque, C. Lewis-Azad; M. Kozlov, A. A. Zakhidov, R. H. Baughman, US 8,968,756 B2 (Issued March 3, 2015).

76. “Nanofiber actuators and strain amplifiers”, R. H. Baughman, A. E. Aliev, J. Oh, M. Kozlov, S. Fang, R. Ovalle-Robles, A. A. Zakhidov, US 9,154,058 B2 (Issued Oct. 6, 2015).

77. “Fabrication of biscrolled fiber using carbon nanotube sheet”, S. Fang, M. D. Lima, X. N. Lepro-Chavez, J. Carretero-Gonzalez, E. Castillo-Martinez, R. Ovalle-Robles, C. S. Haines, D. M. Novitski, M. H. Haque, C. Lewis-Azad; M. Kozlov, A. A. Zakhidov, R. H. Baughman, US 9,243,351 B2 (Issued January, 2016). This is a divisional of the same patent filing as US 8,968,756 B2.

78. “Fabrication and application of nanofiber ribbons and sheets and twisted and non-twisted nanofiber yarns”, US 9,481,949, M. Zhang, S. Fang, R. H. Baughman, A. A. Zakhidov, K. R. Atkinson, A. E. Aliev, S. Li, C. Williams (Scheduled issuance, Dec. 1, 2016). This is a divisional of the same patent filing as for US 8,926,933.

79. “Nanofiber ribbons and sheets and fabrication and application thereof”, US 9,512,545, M. Zhang, S. Fang, R. H. Baughman, A. A. Zakhidov, K. R. Atkinson, A. E. Aliev, S. Li, C. Williams. (Issue Date: January 6, 2016).This is a divisional of the same patent filing as for US 8,926,933.)

80. “Fabrication of biscrolled fiber using carbon nanotube sheet”, US 9,243,351 B2, S. Fang, M. D. Lima, X. N. Lepro-Chavez, J. Carretero-Gonzalez, E. Castillo-Martinez, R. Ovalle-Robles, C. S. Haines, D. M. Novitski, M. H. Haque, C. Lewis-Azad; M. Kozlov, A. A. Zakhidov, R. H. Baughman (Publication Date: January 6, 2016).This is a divisional of same patent filing as for US 8,968,756 B2.

FILED UNITED STATES AND PCT PATENTS

“Sheath-Core Fibers For Superelastic Electronics, Sensors, And Muscles”, GT No.: 139021.027001, UTD Tech ID No.: 15-066, Serial No.: PCT/US16/42579 Filing Date: 07/15/2015

INVITED LECTURES SINCE 2000

"Self-Assembled Nanostructures: From Metallic and Dielectric Photonic Crystals to Carbon Nanotube Artificial Muscles", Johns Hopkins Univ. (Jan. 26, 2000).

“Giant Non-Faradaic Charge Transfer for Carbon Single-Wall Nanotubes: Optical, Electronic, and Dimensional Effects, and their Applications”, *Fourth International Topical Conference on Optical Probes of Conjugated Polymers and Photonic Crystals* (Feb. 15-19, 2000)

“Multifunctional Carbon Nanotube Charge-Transfer Complexes: Structural, Actuator, Energy Storage, and Energy Harvesting Functions”, AMRI/DARPA Symposium (New Orleans, March 2-3, 2000) and XIV th International Winter School on Electronic Properties of Novel Materials (Austria, March 5-11, 2000)

“Carbon Nanotube Electromechanical Macro-Actuators and Micro-Actuators”, SPIE International Symposium on Smart Structures and Materials (Newport Beach, CA, March 5-9, 2000)

“Photonic Crystals Based on Metals, Semiconductors, and Insulators”, ACS National Meeting (San Francisco, CA, March 26-30, 2000)

“Carbon Nanotube Actuators”, Invited Lecture, American Physical Society March Meeting (Minneapolis, MN, March 20-24, 2000)

“The Science and Early Technology of Carbon Nanotube Artificial Muscles”, Knowledge Foundation Symposium (Miami, Florida, April 10-11, 2000)

“Carbon Nanotube Artificial Muscles”, *The 23rd Annual Condensed Matter Meeting of The Brazilian Physical Society* (São Lourenço, Brazil, May 9-13, 2000)

“Multifunctional Carbon Nanotube Charge-Transfer Complexes: Structural, Actuator, Energy Storage, and Energy Harvesting Functions”, *Australia Workshop on Carbon Nanotechnology* (University of Wollongong, Australia, June 8-9, 2000)

"Carbon Nanotubes for Actuator, Energy Storage, and Energy Harvesting Applications", *International Conference on Synthetic Metals* (Gastein, Austria, July 15-21, 2000) and Argonne National Laboratory (Argonne, Illinois, Nov. 6, 2000).

"Carbon Nanotube Charge-Transfer Complexes for Artificial Muscle, Energy Storage, and Energy Harvesting", Royal Institute of Technology (Stockholm, Dec. 8, 2000).

"Electrical, Chemical, and Photoactuators Based on Single-Wall Carbon Nanotubes", *Fifth Workshop on Multifuctional Polymers and Smart Polymer Systems* (University of Wollongong, Australia, January 4-6, 2001) and *AMRI/DARPA Symposium* (New Orleans, Feb. 22-23, 2001).

“Carbon Nanotubes for Artificial Muscles, Energy Storage, and Energy Harvesting”, (Columbia Univ., Feb. 26, 2001).

"Applications Arising from the Nobel Prize Winning Discovery of Conducting Polymers", *Symposium to Celebrate the 2000 Nobel Prize in Chemistry* (Univ. Penn., May 4-5, 2001).

"Photonic Crystals by Self-Assembly and Nanomolding: From Novel Lasers to Green Technology Colorants and Optical Switches" *Organic Thin Films Gordon Conference* (Newport, Rhode Island, June 24-29, 2001).

“Actuation, Energy Storage, and Energy Harvesting Using Carbon Nanotubes”, *Materials Research for Defense-After-Next* (Woods Hole Center of the National Academy of Sciences, June 26-28, 2001).

“Carbon Nanotube Charge Transfer Complexes for Artificial Muscles, Energy Storage, and Energy Harvesting”, *Conference on Electroactive Polymers and Biosystems* (Tuscany, Italy, July 30-August 3, 2001)

“Carbon Nanotubes for Artificial Muscles, Energy Storage, and Energy Harvesting”, 2001 Tulane Engineering Forum, *Advanced Materials: Research, Development, and Applications* (Tulane University, Sept. 21, 2001).

“Carbon Nanotubes for Artificial Muscles, Energy Storage, and Energy Harvesting”, *Annual Symposium of the Center for Collective Phenomena in Restricted Geometries* (Penn. State Univ., Oct. 12-14, 2001).

“Mutifunctional Carbon Nanotube Composites for Actuation, Energy Storage, and Energy Harvesting”, *Nanoscience in a Mega-City* (Hunter College, City University of New York, Oct. 20, 2001).

“Actuation, Energy Storage, and Energy Harvesting Using Carbon Nanotubes from Rice/CNI”, *Rice University* (Nov. 1, 2001).

“Publication of Your Best Work in Science and Nature: Requirements, Strategies, and Dangers” (Jilin University, China, Nov. 11, 2001).

“Carbon Nanotubes for Actuation in Artificial Muscles, Energy Storage, and Energy Harvesting” (Jilin Univ., China, Nov. 11, 2001 and Hong Kong University of Science and Technology, China, Nov. 16, 2001).

“Artificial Muscles Based on Carbon Nanotubes”, Materials Research Society Fall Meeting (Boston, Nov. 26-30, 2001).

“Artificial Muscles Based on Carbon Nanotubes”, *The First International Conference on Artificial Muscles* (National Institute of Advanced Industrial Science and Technology, Osaka, Japan, Dec. 12-14, 2001).

“Recent Advances for Carbon Nanotube Artificial Muscles”, *International Workshop on Advanced Materials for Sensors and Actuators: Role of Nanotechnology* (University of Wollongong, Wollongong, Australia, Feb. 12-14, 2002) and *AMRI/DARPA Symposium* (New Orleans, March, 2002).

“Carbon Nanotube Actuators Based On Double-Layer Charge Injection: From Materials Processing to Device Physics and Performance”, *SPIE's Electroactive Polymer Actuators and Devices* (San Diego, CA, March 17-21, 2002).

“Experimental and Theoretical Characterization of Artificial Muscles Based on Charge Injection in Carbon Nanotubes”, Invited Lecture, American Physical Society March Meeting (Indianapolis, Indiana, March 18-22, 2002).

“Carbon Nanotubes for Fun and Profit: Tiny Muscles, Noses, Capacitors, and Power Generators”, *Joint Symposium on Nanotechnology at the Border: Economic and Intellectual Impact of the Small World*, (University of Texas at Brownsville, May 3, 2002) and *First NJU-UTD Joint Workshop on Nanoscience and Technology (*Nanjing University, China, June 28-29, 2002).

“Carbon Nanotubes for Artificial Muscles, Energy Storage and Energy Harvesting”, *International Conference on Synthetic Metals* (Shanghai. China, June 29 to July 5, 2002).

“Carbon Nanotubes for Artificial Muscles, Energy Storage and Energy Harvesting”, *International Interactive Textiles Conference for the Warrior System* (Nadick, MA, July 9-11, 2002) and *3M Corporation* (Minneapolis, MN, July 2002).

“Related Photo, Thermal, and Charge Injection Driven Processes and Devices Based on Single Walled Carbon Nanotubes” *NATO-ARW Meeting on Organic Nanophotonics* (Aix en Provence, France, August 25-29, 2002).

“Carbon Nanotubes for Artificial Muscles, Energy Storage and Power Generation”, Texas Systems Day Conference (Arlington, TX, Sept 28, 2002).

“Applications Prospects for Carbon Nanotubes”, Honeywell Bendix/JURID Guest Lecture, Society of Automotive Engineers 20th Annual Brake Colloquium (Phoenix, Arizona, Oct. 6-9, 2002).

"Carbon Nanotubes for Fun and Profit: Tiny Muscles,Noses, Capacitors, and Power Generators " (University of Texas at Arlington, Oct. 11, 2002).

“Carbon Nanotubes for Fun and Profit – Tiny Muscles, Noses, and Power Generators”, Raymond F. Boyer Lecture Series in Macromolecular Science and Engineering (Case Western Univ., Oct. 25, 2002).

“Carbon Nanotubes for Artificial Muscles, Energy Storage and Power Generation”, The American Vacuum Society (Denver, Nov. 4-8, 2002).

“Carbon Nanotube Actuators: From Fundamental Physics to Device Performance and Targeted Applications”, *First World Conference on Biomimetics and Artificial Muscles* (Albuquerque, NM, Dec. 9-11, 2002).

“Super Tough Nanotube Composite Fibers for Electronic Textiles”, *International Workshop on Electronic Fibers and Textiles* (University of Wollongong, Australia, Feb. 12-14, 2003) and *International Conference on Advanced Materials and Nanotechnology* (Wellington, New Zealand, Feb. 5-7, 2003).

"Carbon Nanotubes Arrays and Continuous Fibers for the Harvesting, Storage, Conversion, and Absorption of Energy", NANOVENTURES 2003 (Richardson, TX, Feb. 26-28, 2003).

“Super Tough Nanotube Composite Fibers for Electronic Textiles”, *XVIth International Winterschool on Electronic Properties of Novel Materials* (Kirchberg, Austria, March 9-14, 2003).

“Important Computational Challenges in Nanotechnology”, *24th Annual Meeting of the Council of Chemical Research (*Austin, Texas, April 5-8, 2004).

“Energy Transforming Carbon Nanotube Fibers”, *2003 Materials Research Society Spring Meeting* (April 21-25, 2003).

“Carbon Nanotubes for Fun and Profit: Tiny Muscles, Noses, and Power Generators”, Raymond F. Boyer Lecturer, Case Western Reserve University (April 18, 2003).

Purity and Dispersion Effects in Using Carbon Nanotubes for Super-Tough Continuous Fibers, Actuation, Energy Harvesting and Storage, and Electronic Textiles”, *NIST Workshop on Nanotubes* (Gaithersburg, MD, May 27-29, 2003).

“Carbon Nanotubes for Super-Tough Continuous Fibers, Actuation, Energy Harvesting and Storage, and Electronic Textiles”, *Oklahoma NSF EPSCoR Annual Conference* (May 15, 2003, Stillwater, OK).

“Super Tough Nanotube Composite Fibers for Artificial Muscle and Electronic Textile Applications”, *2003 Nano Summit Conference* (Houston, Texas, July 31, 2003) and “Carbon Nanotube Chemi-Mechanical and Piezo-Electrochemical Sensors”, *2003 Gordon Research Conference on Chemical Sensors and Interfacial Design* (Newport, RI, Aug. 2003).

“Super Tough Nanotube Composite Fibers For Artificial Muscle and Electronic Textile Applications”, First Annual SPRING Meeting on Nanoscience and Nanotechnology (Austin, Texas, August 25-27, 2003).

“Super Tough Nanotube Composite Fibers for Artificial Muscle and Electronic Textile Applications”, *2003 Oesper Symposium* (Oct. 10-11, 2003, Cincinnati, OH) and 2003 Materials Research Society Spring Meeting (Dec. 1-5, Boston, MA, 2003).

"Carbon Nanotubes for Fun and Profit: Tiny Muscles, Noses, Capacitors, and Power Generators ", *Environmental Protection Agency* (Dallas, Texas, January 15, 2004).

“Multifunctional Carbon Nanotube Fibers”, *IEEE/NANO-2004* (, Miami, Florida, Feb. 15-19, 2004).

“Transforming Electrolyte-Free CNT Properties By Liquid-State Electrochemical Double-Layer Charge Injection”, *International Winter School on Electronic Properties of Novel Materials* (Kirchberg, Austria, March 6-13, 2004).

“Multifunctional Carbon Nanotube Fibers”, *NSF/AFRL/ARL/ONR Workshop on the Nanotube-Reinforced Composite Materials for Multifunctional Applications* (Florida State Univ., Tallahassee, March 23-24, 2004).

“The Future is Small: Nanotechnology”, National Association of Computer Consultant Businesses (Dallas, Texas, April 13, 2004).

Baughman, Ray H., “Super Tough Nanotube Composite Fibers for Artificial Muscle and Electronic Textile Applications”, *Materials Research Colloquium* (Harvard University, April 11, 2004).

“Tough Nanotube Composite Fibers for Artificial Muscle Applications”, *The Second Conference on Artificial Muscles - Biomimetic System Engineering* (Osaka, Japan, May 20-21, 2004).

“Transforming Electrolyte-Free Carbon Nanotube Properties By Liquid-State Electrochemical Double-Layer Charge Injection”, *International Conference on Synthetic Metals* (Wollongong, Australia, June 28-July 2, 2004).

“Carbon Nanotubes for Super-tough Continuous Fibers, Actuation, Energy Harvesting and Storage, and Electronic Textiles”, Plenary Lecture, *XIII International Materials Research Congress"* (August 22-26, 2004, Cancun, Mexico).

“High Performance Carbon Nanotube Fibers – A Glimpse at the Future”, *The Fibers Conference 2004* (Sept. 15-16, 2004, Greensville, SC).

“Continuous Nanotube Yarns and Fibers and Their Properties for Multifunctional Applications”, NASA Grand Challenge Workshop on *Nano for Space Exploration* (NASA Ames, Moffett Field, CA, August 24-26, 2004).

“Super Tough Carbon Nanotube Fibers for Artificial Muscle and Electronic Textile Applications”, After Dinner Speaker for American Institute for Chemical Engineers Meeting (Dallas, TX, Oct. 21, 2004).

"In Vacuo Retention of Nanostructure Properties Switched by Liquid-State Double-Layer Charge Injection", Second Annual SPRING Meeting on Nanoscience and Nanotechnology (Dallas, Texas, Nov. 11-13, 2004).

“Strange, Useful, and Problematic Mechanical Properties of Carbon Nanotube Sheets and Fibers”, *2004 Materials Research Society Fall Meeting* (Boston, MA, Nov. 29-Dec. 3, 2004).

“Nanomaterial Properties Switched by Double-Layer Charge Injection and Retained in Vacuum”, *2004 Materials Research Society Fall Meeting* (Boston, MA, Nov. 29-Dec. 3, 2004).

“A New Type of Artificial Muscle Yarn for Artificial Muscle and Other Multifunctional Materials Applications”, *Second World Conference on Biomimetics, Artificial Muscles, and NanoBio* (Dec. 6-8, 2004, Albuquerque, NM).

“Strange, Useful, and Problematic Mechanical Properties of Carbon Nanotube Sheets and Fibers”, *Rice University* (Dec. 13, 2004, Houston, TX).

“A New Type of Artificial Muscle Yarn for Artificial Muscle and Other Multifunctional Materials Applications”, *Carbon Nanotube Reinforced Composites Workshop - NASA, CAER, UK* (Jan. 11-12, 2005, Univ. Kentucky, Lexington, Kentucky).

“A New Type of Artificial Muscle Yarn for Artificial Muscle and Other Multifunctional Materials Applications”, *Wright-Patterson Air Force Base* (Jan. 18, 2005, Dayton. Ohio).

“A New Type of Carbon Nanotube Yarn for Artificial Muscle and Other Multifunctional Materials Applications”, *NIST/NASA Workshop on Measurement Issues in Single-Walled Carbon Nanotubes* (Jan. 26-28, 2005, Gaithersburg, Maryland).

“Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle and Other Multifunctional Applications”, *Workshop on Nanostructured Electronic Materials*, University of Wollongong (Feb. 2-3, 2005, Wollongong, Australia).

“Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, and Field Emission Applications”, *Workshop on NanoScience for Advanced Applications* (Feb. 16-19, 2005, Guanajuato, Mexico).

“Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, and Field Emission Applications”, University of Texas at Austin (Feb. 23, 2005, Austin, TX).rg

"Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle and Other Multifunctional Applications", *XIXth Annual International Winter School Euroconference on Electronic Properties of Novel Materials* (March 12-19, 2005, Kirchberg, Austria).

"A New Type of Carbon Nanotube Yarn for Artificial Muscle and Other Multifunctional Materials Applications", *SPIE's International Symposium on Smart Structures and Materials* (March 7-10, 2005, San Diego, CA).

"Gaint Double-Layer Charge Injection Without Contacting Electrolyte: Properties Tuning and Device Applications", *Spring Meeting of the Materials Research Society* (March 28-April 1, 2005, San Francisco).

"Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, and Field Emission Applications", *2nd Conference on Nanoscale Devices and System Integration* (April 4-6, 2005, Houston, Texas).

"Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, and Field Emission Applications", Lockheed Martin (April 12, 2005, Fort Worth, Texas).

"The Science of Nanofabrication", Online Discussion for EurekAlert (April 19, 2005).

"Knotty Carbon Nanotube Yarns", *U.S.-Mexico Workshop on Knots in Biological Sciences* at the University of Texas at Dallas (April 28, 2005, Richardson, Texas).

"Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, and Field Emission Applications", *First International Workshop of NANO Systems Institute* (May 30-31, 2005, Seoul, Korea).

"Gaint Double-Layer Charge Injection Without Contacting Electrolyte: Properties Tuning and Device Applications", *Physics Department, Seoul National University* (June 1, 2005, Seoul, Korea).

"Artificial Muscles", *IDGA's Nanotechnology for Defense Conference* (July 26, 2005, Washington, DC).

"Draw-Twist-Spun Multiwalled Carbon Nanotubes for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, and Field Emission Applications", *Nano Summit Research Conference* (July 28, 2005, Houston, Texas).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: *Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications*", SPRING Consortium Taiwan Workshop, Omni Hotel (August 2, 2005, Dallas, Texas).

"Multifunctional Nanotube Yarns and Sheets: From Fabrication to Science and Applications", *TiiMS URETI Annual Meeting*, Texas A&M (August 3, 2005, College Station, Texas).

"Multiwalled Nanotube Yarns and Sheets for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, Field Emission, and Other Applications", *Keynote Lecture, ASME Integrated Nanosystems Conference* (September 13, 2005, Berkley, California).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: *Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications*", Textron Webex Lecture (September 12, 2005, Dallas, Texas).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: *Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications*", *Dean's Distinguished Lecture* (Sept. 26, 2005, Univ. of Texas, Brownsville).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: *Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications",* DuPont Corporation (September 22, 2005, Columbus, Ohio).

"Draw-State fabricated Nanotube Yarns and Textiles for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, Display, Field Emission and Other Applications", *Santa Fe Workshop on Nanoengineered Materials and Macro-Molecular Technologies* (Oct. 3-7, 2005, Santa Fe, New Mexico).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: *Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications*", Bell Helicopter (Oct. 5, 2005, Hurst, Texas).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: *Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications*", Third Annual Spring Conference, Rice University (Oct. 10-11, 2005, Houston, Texas).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications", *1st Nanoscience and Applications Conference of NIST* (Oct. 17-19, 2005, Boulder, Colorado).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit", *Evening Public Lecture* (Nov. 9, 2005, University of Texas at Dallas, Dallas, Texas)

"*POST PATENT FILING UPDATE ON:* Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit", *Materials Science and Engineering Seminar Program* (Nov. 11, 2005, Texas A&M, College Station, Texas).

"Carbon Nanotube Yarns and Sheets for Energy Generation, Storage, and Transmission", *Energy and Nanotechnology Workshop III*, Baker Institute for Public Policy, Rice University (November 15, 2005, Houston Texas).

"Draw-State Fabricated Nanotube Yarns and Textiles for Artificial Muscle, Structural, Energy Storage, Energy Harvesting, Display, Field Emission and Other Applications", *Vanderbilt University* (Dec. 6, 2005, Nashville, Tennessee).

"Multifunctional Carbon Nanotube Yarns and Transparent Sheets for Fun and Profit", *3rd Taiwan/US Air Force Nanoscience and Nanotechnology Workshop* (Feb. 9-11, 2006, Hualien, Taiwan)

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit", *Electromaterials Science Symposium* (Feb. 15-17, 2006, Wollongong, Australia).

"Expanding the Nanotech Frontier", *Dallas/Fort Worth American Chemical Society Meeting* (Feb. 23, 2006, Dallas Texas).

"Fuel Powered Artificial Muscles", *SPIE Smart Structures and Materials Symposium* (Feb. 26-March 2, 2006, San Diego, CA).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", *XXth Annual International Winter School Euroconference on Electronic Properties of Novel Materials* (March 4-11, 2006 Kirchberg, Austria).

"The Solid-State Fabrication, Structure, and Multifunctional Applications of Strong Carbon Nanotube Yarns and Transparent Sheets", *Invited Talk for the March Meeting of the American Physical Society* (March 12-17, 2006, Baltimore, Maryland).

"Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit: *Artificial Muscle, Electronic Textile, Energy Storage and Harvesting, Display, Electron Emission, and Other Applications*", Techtextile North America 2006 Symposium (March 28-30, 2006, Atlanta, Georgia).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", *International Meeting on Chemistry of Nanotubes: Science and Applications* (April 2-5, 2006, Arcachon, France).

"Multifunctional Carbon Nanotube Yarns and Self-Woven Nanotube Sheets by Solid-State Processing for Textile Applications", *Materials Research Society Spring Meeting* (April 17-21, 2006, San Francisco).

"Solid-State Fabrication, Structure, and Applications of Carbon Nanotube Yarns and Transparent Sheets", *2006 NanoMaterials for Defense Applications* (May 1-4, 2006, Virginia Beach, Virginia).

"The Future is Small", *Eddie Bernice Johnson Math and Science Lecture for High School Students* (May 15, 2006, Townview Center, Dallas, Texas).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", *Oklahoma NSF EPSCOR Annual State Conference* (May 18, 2006, Norman, Oklahoma).

“Nanostructured Materials and Their Applications: From Artificial Muscles and Electronic Textiles to Vaccine Indicators”, *MEDICAL DEVICES: TODAY AND TOMORROW, Medical Device Action Alliance* (Irving, Texas, May 23, 2006).

“The High Speed Production, Properties, and Applications of Carbon Nanotube Yarns and Transparent Sheets”, *International Conference on Synthetic Metals* (Dublin, Ireland, July 2-7, 2006).

"New Technologies from UTD's NanoTech Institute: From High Performance Nanotube Yarns and Sheets to Fuel-Powered Artificial Muscles", The 6th Emerging Information Technology Conference (Dallas, Texas, August 10-11, 2006).

“Negative Poisson Ratios and Linear Compressibilities for Carbon Nanotube Sheets and Yarns”, *Auxetics 2006* (Univ. of Exeter, UK, Sept. 4-6, 2006).

“Multifunctional Carbon Nanotube Yarns and Transparent Sheets for Fun and Profit”, *Presidential American Chemical Society Symposium in memory of Richard Smalley* (Sept. 10-14, San Francisco).

“Fuel Powered Artificial Muscles”, NanoBio Convergence Group Lecture Series (Sept. 13, 2006, Menlo Park, CA).

“NanoTech Institute Inventions: From Multifunctional Carbon Nanotube Yarns and Transparent Metallic Sheets to Fuel-Powered Muscles and Devices for Energy Harvesting, Storage, and Conversion”, NanoTX’06 Conference on *The Promise of Tomorrow, The Business of Nanotechnology* (Sept. 27-28, 2006, Dallas, TX)

“Giant Double-Layer Charge Injection Without Contacting Electrolyte”: Properties Tuning and Device Applications”, Shimane-Dallas Metroplex Workshop (Sept. 29, 2006, Richardson, Texas).

“Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets”, *After Dinner Speech, American Institute of Aeronautics and Austronautics* (Oct. 19, 2006, Fort Worth, Texas).

“Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets”, *US-Ireland R&D Partership Nanotechnology Workshop* (Nov. 23-24, 2006, Belfast, Ireland).

“Novel Technologies for Fabricating and Applying Multifunctional Carbon Nanotube Yarns and Transparent Sheets”, Keynote Lecture for SAMPE Conference: *Global Advances in Materials and Process Engineering* (Nov. 6-9, 2006, Dallas, TX).

“Multifunctional Carbon Nanotube Yarns and Textiles for Fun and Profit”, *NASA Nanobriefs’ National Nano Engineering Conference* (Nov. 9-10, 2006, Boston, MA).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", *North Carolina State Univ*. (Nov. 13, 2006, Rayleigh, North Carolina).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", *Columbia, University* (Nov. 15, 2006, New York City).

"From Multifunctional Carbon Nanotube Yarns and Transparent Sheets to Fuel-Powered Muscles and Devices for Energy Harvesting, Storage, and Conversion". *Carnegie Mellon University* (Nov. 21, 2006, Pittsburgh, PA).

"From Electrical to Fuel Powered Artificial Muscles", *Fall Materials Research Society Meeting* (Nov. 29-Dec. 1, Boston, Massachusetts).

"Strain Amplification for Artificial Muscles and Sensors Using Giant Poisson Ratios and Giant Linear Compressibilities", *Fall Materials Research Society Meeting* (Nov. 29-Dec. 1, 2006, Boston, Massachusetts).

"NanoTech Institute Inventions: From Multifunctional Carbon Nanotube Yarns and Transparent Metallic Sheets to Fuel-Powered Muscles and Devices for Energy Harvesting, Storage, and Conversion", *International Conference on Nanoscience and Nanotechnology* (Dec. 7-8, 2006, Guangji, Korea).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", Chonnam University (Dec. 8, 2006, Guangji, Korea).

"From Electrical to Fuel Powered Artificial Muscles", KITECH (Dec. 8, 2006, Seoul, Korea).

"From Electrical to Fuel Powered Artificial Muscles", Hanyang University (Dec. 11, 2006, Seoul, Korea).

"From Electrical to Fuel Powered Artificial Muscles", *2006 International Workshop on Innovations and Advanced Studies –Energy, Biomedicine, Enabling Materials and Micro-Nano Science and Technology*, National Cheng Kung Univ. (Dec. 13-15, 2006, Tainan, Taiwan).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", Northrop Grumman Lecture Series (January 8, 2007, Los Angeles, California).

"From Electrical to Fuel Powered Artificial Muscles", Award Lecture for Kapitza Metal (Jan. 18, 2007, Moscow, Russia).

"From Multifunctional Carbon Nanotube Tarns and Transparent Sheets to Fuel-Powered Muscles and Devices for Energy Harvesting, Storage, and Conversion", *Honeywell Corporation* (January 22, 2007, Morristown, New Jersey).

"Strain Amplification for Artificial Muscles and Sensors Using Giant Poisson Ratios and Giant Linear Compressibilities", *2nd International Symposium on Electromaterials Science* (Feb. 7-9, 2007, Wollongong, Australia).

"From Electrical to Fuel Powered Artificial Muscles", *Euroconference on Electronic Properties of Novel Materials* (March 10-16, 2007, Kirchberg, Austria).

"Autonomous Carbon Nanotube and Shape Memory Yarn, Sheet, and Wire Systems", *SPIE Smart Structures and Materials Symposium* (March 18-22, 2007, San Diego, CA).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", *The Best Little Nano Conference in Texas* (Austin, Texas, April 4-5, 2007).

"Solid-State Fabrication of High Performance Carbon Nanotube Yarns and Transparent Sheets and Their Multifunctional Applications", *3rd International Symposium on NANOSTRUCTURED AND FUNCTIONAL POLYMER-BASED MATERIALS AND NANOCOMPOSITES* (May 13-15, 2007, Corfu, Greece).

"New Technologies from UTD's NanoTech Institute", Banquet Lecture for *Raytheon's 7th Electro-Optical Systems Technology Network Conference* (May 15-16, 2007, Richardson, Texas).

"From Multifunctional Carbon Nanotube Yarns and Transparent Sheets to Fuel-Powered Muscles and Devices for Energy Harvesting, Storage, and Conversion", Dinner Lecture for *Institute for Innovation and Invention* (June 14, 2007, Richardson, Texas).

"From Electrical to Fuel Powered Artificial Muscles", Southern Methodist University (July 13, 2007, Dallas, Texas).

"NanoTech Institute Inventions: From Multifunctional Carbon Nanotube Yarns and Transparent Metallic Sheets to Fuel-Powered Muscles and Devices for Energy Harvesting, Storage, and Conversion", Evening lecture for *The Indus Entrepreneurs* (June 14, 2007, Dallas, TX).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets, *Carbon 2007* (July 15-20, 2007, Seattle, Washington)

"From Electrical to Fuel Powered Artificial Muscles", *Texas-Korea Nano Workshop* (August 6-8, 2007, Richardson, TX).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets, *Department of Aerospace Engineering, University of Illinois* (Sept. 24, 2007, Urbana-Champaign, Illinois).

"NanoTech Institute Inventions: Transparent Metallic Sheets, Fuel-Powered Muscles and More", *MetroCon (IEEE) Conference* (Oct. 10, 2007, Arlington, TX).

"From Multifunctional Carbon Nanotube Yarns and Transparent Sheets to Fuel-Powered Muscles and Devices for Energy Harvesting, Storage, and Conversion", *General Electric* (Oct. 23, 2007, Niskayuna, NY).

"Nanotechnology for Fun and Profit", *Carnegie Mellon University Lecture Series* - Lecture preceding receipt of 2007 Distinguished Alumni Award (Oct. 26, 2007, Pittsburgh, PA).

"From Electrical to Fuel-Powered Artificial Muscles", Plenary Lecture at *2007 National Nano Engineering Conference*, prior to receiving Nano 50 Award for Fuel-Powered Artificial Muscles (Nov. 14, 2007, Boston, Massachusetts).

"Nanotechnology for Fun and Profit", *Petersen Institute of NanoScience and Engineering, University of Pittsburgh* (Feb 4, 2008, Pittsburgh, PA).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", *Monash University* (Feb. 21-22, 2008, Melbourne, Australia).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", *US AFRL-Israeli Bio/Nano Workshop for Materials* (March 24-25, 2008, San Francisco, CA).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", *ChemOnTubes 08*, (April 6-9, 2008, Zaragoza, Spain).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", *Nano for Defense Applications* (April 21-23, 2008, Arlington, Virginia).

"Nanotechnology for Fun and Profit", *Hoby Youth Leadership Conference* (May 16, 2008, Dallas, TX).

"Fabrication and Multifunctional Applications of Carbon Nanotube Yarns and Self-Woven Sheets", *Third International Conference on Smart Materials Structures and Systems* (June 8-13, 2008, Acireale, Sicily).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", Keynote Lecture, *2nd New Diamond and Nano Carbon* (May 26-29, 2008, Taipei, Taiwan).

"Solid-State Fabrication, Structure, and Multifunctional Applications of Carbon Nanotube Yarns and Transparent Sheets", *POLYMER FIBRES 2008* (July 9-11, 2008, University of Manchester, UK).

"Nanotechnology for Fun and Profit", *Technology Club of Dallas* (August 12, 2008, Dallas, TX).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", Korea Advanced Institute of Science and Technology (Sept. 4, 2008, Daejeon, South Korea).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", Seminar Series of Hanyang Univ. (Sept. 5, 2008, Seoul, South Korea).

Bayer Polymer Engineering Lectures: "Nanotechnology for Fun and Profit" and "Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member" (Sept. 18-19, 2008, Univ. of Akron).

"Nanotechnology: Having Fun in Scientific Discovery and Generating New Products", Hispanic Science and Technology Program (Sept. 22, 2008, University of Texas, Pan American).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", NanoTX 08 (Oct. 2, 2008, Dallas, Texas).

"Diverse Carbon Nanotube Artificial Muscles Meet an Exciting New Family Member", Georgia Institute of Technology (Oct. 27, 2008, Atlanta, GA)

"Nanotechnology for Fun and Profit", *Raytheon Day of Learning* (Nov. 3, 2008, Univ. of Texas at Dallas, Richardson, Texas).

"Fuel Powered and Electrically Powered Artificial Muscles Using Carbon Nanotubes and Shape Memory Alloys", IEEE-Electron Devices Society (Nov. 18, 2008, University of Texas at Arlington, Arlington, Texas).

"Nanotube Applications: From Fascinating Materials to Increasingly the Marketplace", *XXIIIrd International Winterschool on Electronic Properties of Novel Materials* (March 7-14, 2009, Kirchberg Austria).

"Fuel Powered and Electrically Powered Artificial Muscles Using Carbon Nanotubes and Shape Memory Alloys", *Nanotechnology for Defense* (Burlingame, CA, April 6-9, 2009).

"Giant Stroke, Superelastic Carbon Nanotube Aerogel Muscles", *Nanotech 2009*, *Clean Technology 2009 and TechConnect Summit 2009* (May 3-7, 2009, Houston, Texas).

"Giant Stroke, Superelastic Carbon Nanotube Aerogel Muscles", Asian Research Network Symposium and Texas-Korea Nanotech Workshop (Seoul, Korea, May 18-20, 2009).

"The Promise of Nanotechnology", Conference on *Workforce Vitality in the Molecular-Era Economy*, Cowboy Stadium, Arlington, Texas (August 14, 2009).

"Giant Stroke, Superelastic Carbon Nanotube Aerogel Muscles", Rusnanotech Nanotechnology International Forum (Moscow, Oct. 6-8, 2009).

"Carbon Nanotube Aerogels as Giant Stoke Artificial Muscles and the Basis for New Multifunctional Composites", *Composites at Lake Louise* 2009 (Lake Louise, Canada, Oct. 25-30, 2009).

"Harvesting Waste Thermal Energy Using a Carbon-Nanotube-Based Thermal-Electrochemical Cell", *University of Wollongong* (Wollongong, Australia, Feb. 16, 2010).

"Giant Stroke, Superelastic Carbon Nanotube Aerogel Muscles", *5th Annual International Electromaterials Symposium* (University of Melbourne, Australia, Feb. 17-19, 2010).

"Publication of Your Best Work in *Science* or *Nature* - Requirements, Strategies, and Dangers", The *3rd International Workshop on Interdisiplinary Sciences* (April 4, 2010, National Research Foundation of Korea, Korea).

"Superelastic Carbon Nanotube Muscles Providing Giant Strokes and Giant Stroke Rates from 0 to 1900 K", Graffin Lecture presented at Pennsylvania State University (April 18, 2010, University Park, PA)

"Carbon Nanotube Yarns and Sheets for Energy Harvesting, Energy Conversion, and Energy storage", Graffin Lecture presented at Northwestern University (April 22, 2010, Evanston, Illinois).

"Superelastic Carbon Nanotube Muscles Providing Giant Strokes and Giant Stroke Rates from 0 to 1900 K", Lecture upon Award of the Honorable Yang Shixian Professorship (April 27, 2010, Nankai University, Tianjin, China).

"Superelastic Carbon Nanotube Muscles Providing Giant Strokes and Giant Stroke Rates from 0 to 1900 K", Institute of Physics, Chinese Academy of Science (April 28, Beijing, China).

"Harvesting Waste Thermal Energy Using a Carbon-Nanotube-Based Thermal-Electrochemical Cell", College of Physics, Nankai University (April 29, 2010, Tianjin, China).

"The Diverse and Growing Family of Carbon Nanotube and Related Muscles", *First International Nanotechnology Conference* (June 7-11, 2010, Quito, Ecuador).

"The Diverse and Growing Family of Carbon Nanotube and Related Muscles", Keynote Lecture, *11th International Conference on the Science and Technology of Nanotubes, NT10* (June 27-July 2, 2010, Montréal, Québec, Canada).

"The Diverse and Growing Family of Carbon Nanotube and Related Muscles", Keynote Lecture, *International Conference on Science and Technology of Synthetic Metals* (July 4-9, 2010, Kyoto, Japan).

"Multifunctional Nanostructured Yarns and Fabrics for Energy and Other Applications", *Second International Workshop on Nanocarbon Photonics and Optoelectronics* (August 1-6, 2010, Koli, Finland).

"Multifunctional Nanostructured Yarns and Fabrics for Energy and Other Applications", *9th US-Korea Workshop on Nanostructured Materials* (August 10-12, 2010, Seattle, Washington).

"Multifunctional Nanostructured Yarns and Fabrics for Energy and Other Applications", *Southwest Research Institute* (Sept. 10, 2010, San Antonio, Texas).

"Multifunctional Nanostructured Yarns and Fabrics for Energy and Other Applications", *University of Texas at San Antonio* (Sept. 10, 2010, San Antonio, Texas).

"Multifunctional Nanostructured Yarns and Fabrics for Energy and Other Applications", Keynote Lecture, *Nanotechnology Materials and Devices Workshop 2010*, University of Cincinnati (Oct. 4, 1010, Cincinnati, Ohio).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets", *2010 Xerox Distinguished Lecture Series*, Xerox Research Center of Canada (Oct. 8, 2010, Toronto, Canada).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", Nankai University (Oct. 14, 2010, Tianjin, China).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", Lecture for Honorable Tang Aoqing Professorship, Alan G. MacDiarmid Institute, Jilin University (Oct. 19, 2010, Jilin, China).

"Spinning the Unspinnable by Biscrolling CSIRO/UTD Nanofiber Sheets and Functional Guests into Yarns", CSIRO (February 8, 2011, Melbourne, Australia).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", Electromaterials Symposium 2011, University of Wollongong (Feb. 9-11, 2011, Wollongong, Australia).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", Applied Power Electronics Conference 2011 (March 6-10, 2011, Fort Worth, Texas).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", American Physical Society Spring Meeting (March 20-25, 2011, Dallas, Texas).

"Biscrolling Nanofiber Sheets and Functional Guests into Multifunctional Yarns for Energy Applications", University of Utah, Physics Dept. Seminar Series (April 7, 2011, Salt Lake City, Utah).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", Materials Research Society Spring Meeting (April 24-29, 2011, San Francisco)

"Biscrolling Nanofiber Sheets and Functional Guests into Yarns for Multifunctional Applications", Global R&D Forum 2011 (June 6-8, 2011, Seoul, Korea).

"Nanoscale Functional Composites for Energy Applications", Keynote Lecture for The 18th International Conference on Composite Materials (August 21-26, 2011, Jeju Island, Korea).

"Biscrolling Nanofiber Sheets and Functional Guests into Multifunctional Yarns for Energy Applications", China NANO 2011 (Sept. 7-9, 2011, Beijing, China).

"Biscrolling Nanofiber Sheets and Functional Guests into Multifunctional Yarns for Energy Applications", Struttgart NanoDays (Sept. 28-29, 2011, Ludwigsburg, Germany).

"Carbon Nanotube Torsional Muscles", 2011 Nanotechnology Materials and Devices Workshop, University of Cincinnati (Oct. 3, 2011, Cincinnati, Ohio)

"Novel Materials for Energy Storage Solutions", Global Climate and Energy Project Symposium, Stanford University (Oct. 4-5, 2011, Stanford, California).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", *International Congress on Innovative Textiles* (Oct. 20-22, 2011, Istanbul, Turkey).

"Biscrolling Nanofiber Sheets and Functional Guests into Multifunctional Yarns for Energy Applications", *Materials Research Society National Meeting* (Nov. 28-Dec. 1, 2011, Boston).

"The Diverse and Growing Family of Carbon Nanotube and Related Artificial Muscles", *7th Annual International Electromaterials Science Symposium"* (February 15-17, 2012, Geelong, Australia).

"Fabrication and Application Opportunities for Forest-Derived Carbon Nanotube Sheets and Yarns", Conference on *Processing and Fabrication Challenge for Functional Materials*, University of Wollongong (Feb. 20-21, 2012, Wollongong, Australia).

"Carbon Nanotube Sheets and Yarns for Energy Harvesting, Storage, and Conversion", *Carbons for Energy Conversion Symposium of the American Carbon Society* (March 29-30, 2012, Stone Mountain Georgia).

"The Diverse and Growing Family of Carbon Nanotube and Related Artificial Muscles", *Graphene and Green Energy International Symposium* (April 19-22, 2012, Tianjin, China, 2012).

"Biscrolling Nanofiber Sheets and Functional Guests into Multifunctional Yarns for Energy Applications", *International Conference on Synthetic Metals* (July 8-13, 2012, Atlanta, Georgia).

"The Diverse and Growing Family of Carbon Nanotube and Related Artificial Muscles", *ASME 2012 Conference on Smart Materials, Adaptive Structures, and Intelligent Systems* (Sept. 19-21, 2012, Stone Mountain, Georgia).

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles", *11th China International Nanoscience and Technology Symposium* (Oct 21-25, 2012, Kunming, China).

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles", *2012 Nanotechnology Materials and Devices Workshop* (Nov. 5, 6, 2012, Dayton, Ohio).

"Spinning the Unspinnable by Biscrolling Nanofiber Sheets and Functional Guests into Yarns", *Fiber Society's Fall Meeting and Technical Conference* (Nov. 7-9, 2012, Boston).

"Using Nanotechnology to Build High Performance Artificial Muscles", *Leon Kane-Maguire Address*, University of Wollongong (Feb. 13-15, 2013, Wollongong, Australia).

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles", *Jahreskongress Innovationsallianz Carbon Nanotubes* (Feb. 20-21, 2013, Stuttgart, Germany).

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles", *SPIE Smart Structures and Materials Symposium* (March 10-14, 2013, San Diego, CA).

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles" (April 12, 2013, Florida State University, Talahasee).

"Weavable Carbon Nanotube Hybrid Yarn Muscles and Their Applications in Textiles", Keynote Lecture at textile Congress*: Innovative and Functional Textiles* (May 30-31, 2013, Istanbul, Turkey).

"Powerful, large-stroke hybrid carbon nanotube yarn muscles", Fudan University (May 23, 2013, Shanghai, China).

"Multifunctional carbon nanotube yarns for artificial muscles and energy harvesting and energy storing textiles", NANO KOREA 2013 (July 10-12, 2013, Seoul, Korea).

"Multifunctional carbon nanotube yarns for artificial muscles and energy harvesting and energy storing textiles", SGL Award Lecture for *The Annual World Conference on Carbon* (July 14-19, 2013, Rio de Janeiro, Brazil).

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles", *19th International Conference on Composite Materials* (July 28-August 2, 2013, Montreal, Canada).

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles", *7th World Conference on Biomimetics, Artificial Muscles, and Nano-Bio*, (August 26-30, 2013, Jeju Island, Korea).

"NanoTechnology for Fun and Profit", Plenary Dinner Lecture at a meeting of the Texas Section of the American Physical Society (Oct. 11, 2013, Brownsville, Texas)

"High Performance, Electrolyte-Free Torsional and Tensile Carbon Nanotube Hybrid Muscles", Keynote Lecture at The Fiber Society Meeting on *Fibers Interfacing the World* (Oct. 23-25, 2013, Clemson, South Carolina).

"NanoTechnology for Fun and Profit", The INT Physics Days 2013, Karlsruhe Institute of Technology (Nov. 14-15, 2013, Karlsruhe, Germany).

"Artificial Muscles from Fishing Line and Sewing Thread", 9th Annual International Electromaterials Symposium, University of Wollongong (Feb. 12-14, 2014, Wollongong, Australia).

"Artificial Muscles for Fun and Profit", Nanotechnology Materials and Devices Workshop 2014 (Feb. 24-25, 2014, University of Cincinnati, Cincinnati, Ohio).

"The Evolution of Strong, Fast, Powerful, Durable, and Cheap Polymer Artificial Muscles from Carbon Nanotube Muscles", *Stuttgart NanoDays Workshop* (September 17-19, Stuttgart, Germany, 2014).

"The Evolution of Strong, Fast, Powerful, Durable and Cheap Polymer Muscles from Carbon Nanotube Muscles", *Materials Research Society National Meeting* (April 21-25, 2014, San Francisco).

"The Evolution of Strong, Fast, Powerful, Durable and Cheap Polymer Muscles from Carbon Nanotube Muscles", *The 11th International Workshop on Piezoelectric Materials and Applications in Actuators* (Sept. 22-25, 2014, Suzhou, China).

"The Evolution of Strong, Fast, Powerful, Durable and Cheap Polymer Muscles from Carbon Nanotube Muscles", *Mechanical Science and Engineering Seminar Series*, Univ. of Illinois at Urbana-Champaign (Sept. 21, 2014, Urbana, Illinois).

"The Evolution of Strong, Fast, Powerful, Durable and Cheap Polymer Muscles from Carbon Nanotube Muscles", *Rice University Materials Science and Engineering Seminar Series* (Sept. 24, 2014, Houston, TX).

"Biscrolled Multifunctional Nanofiber Yarns for Energy Applications", *10th Annual International Electromaterials Science Symposium* (University of Wollongong, Wollongong, Australia, Feb. 13, 2015).

"Powerful, Giant-Stroke Artificial Muscles from Twisted and Coiled Carbon Nanotube Yarns", *International Winterschool on Electronic Properties of Novel Materials* (Kirchberg, Austria, March 12, 2015).

"The Evolution of Strong, Fast, Powerful, Durable, and Cheap Polymer Artificial Muscles from Carbon Nanotube Muscles", *Complex Systems Seminar Series* (Northwestern University, April 2, 2015).

Strong, Powerful, Lightweight, Nanotube, and Polymer Muscles for Actuation, and Energy Harvesting for Air and Spacecraft", *Northrop Grumman Nanotechnology Workshop* (Redondo Beach, California, July 6, 2015).

"Powerful Artificial Muscles for Morphing Composites", *20th International Conference on Composite Materials* (Copenhagen, Denmark, July 22, 2015).

"Powerful, Giant-Stroke Artificial Muscles From Twisted and Coiled Carbon Nanotube Yarns and Polymer Fibers", *XXIV International Materials Research Congress 2015* (Cancun, Mexico, August 19, 2015).

"Harvesting Waste Chemical and Thermal Energy Using Carbon Nanotube Yarn and Polymer Fiber Muscles", BAMN 2015: *Biomimetics, Artificial Muscle, and Nano-Bio* (Vancouver, Canada, August 24-26, 2015).

"Harvesting Waste Chemical and Thermal Energy Using Carbon Nanotube Yarn and Polymer Fiber Muscles", *10th Energy Harvesting Workshop* (Virginia Tech, Sept. 14, 2015).

"The Evolution of Strong, Fast, Powerful, Durable, and Cheap Polymer Artificial Muscles from Carbon Nanotube Muscles", *Novel Materials – A Symposium of the National Academies of Sciences, Engineering, and Medicine* (National Academies of Sciences Building, Washington, D.C., Oct. 7, 2015).

"Powerful artificial muscles for morphing composites and other applications", *Composites at Lake Louise-2015* (Alberta, Lake Louise, Canada, Nov. 8-12, 2015).

"The Evolution of Strong, Fast, Powerful, Durable and Cheap Polymer Muscles from Carbon Nanotube Muscles", Symposium on Nanomaterials in honor of Prof. Herbert Gleiter, City University of Hong Kong (Hong Kong, Nov. 19, 2015).

"Yarns and Textiles that Sense, Actuate, Harvest, and Store Energy", Seminar Hong Kong Polytechnic Institute (Hong Kong, Nov. 24, 2015).

"Multifunctional Biscrolled CNT and Polymer Yarns for Energy Storing, and Energy Harvesting Textiles and Artificial Muscles", *Materials Research Society Fall Meeting* (Boston, Massachusetts, Dec. 2, 2015).

"Strong, Powerful, Torsional, and Tensile, Artificial Muscles from Twisted and Coiled CNT Yarns", *Materials Research Society Fall Meeting* (Boston, Massachusetts, Dec. 4, 2015).

"Environmentally Powered Yarn Arrays that Sense, Actuate, Harvest, and Store Energy", *11th Annual International Electromaterials Science Symposium* (Deakin University, Melbourne, Australia, Feb. 10-12, 2016).

"Sheath-Core Conducting Fibers for Weavable Superelastic Wires, Biosensors, Supercapacitors, Strain Sensors, and Artificial Muscles", Keynote Lecture at IUTAM

(International Union of Theoretical and Applied Mechanics) Symposium on Mechanics of Stretchable Electronics), (Hanzhou, China, March 17 and 18, 2016)

"Sheath-Core Conducting Fibers for Weavable Superelastic Wires, Biosensors, Supercapacitors, Strain Sensors, and Artificial Muscles", 7th Nanotechnology Materials and Devices Workshop (University of Dayton, Dayton, Ohio, May. 23-25, 2016).

"The Evolution of Strong, Fast, Powerful, Durable, and Cheap Polymer Artificial Muscles from Carbon Nanotube Muscles", *5th International Conference on Smart and Multifunctional Materials, Structures, & Systems" (CIMTEC 2015)* (Perugia, Italy, June 5-9, 2016)

"Environmentally Powered Carbon Nanotube Yarns and Polymer Fibers that Sense, Actuate, Harvest, and Store Energy", *The 24th International Conference on Science and Technology of Synthetic Metals* (Guangzhou, China, June 26-July 1, 2016).

"Thermomechanical, Thermoelectric, and Thermoelectrochemical Electrical Energy Harvesting Using Nanostructured Fibers, Yarns, Sheets, and Textiles", *11th Energy Harvesting Workshop* (Arlington, Virginia, Sept. 6-7, 2016).

"The Evolution Of Strong, Fast, Powerful, Durable, And Cheap Polymer Artificial Muscles From Carbon Nanotube Muscles", Keynote and Kreidl Memorial Lecture at the *28th Rio Grande Symposium on Advanced Materials* (Albuquerque, New Mexico, Oct. 3, 2016).

"The Evolution of Strong, Fast, Powerful, Durable, and Cheap Polymer Artificial Muscles from Carbon Nanotube Muscles", International Union of Materials Research Societies International Conference in Asia (Qingdao, China, Oct. 20-24, 2016).