Thomas W. Kenny

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Education

- University of California, Berkeley
  Ph D Physics June 1989
- University of Minnesota, Minneapolis
  BS Physics March 1983

Experience

Senior Associate Dean of Engineering for Student Affairs, Stanford. 7/15-present.

Director, Founder, recent CEO, BoD Member, Applaud Medical 11/14-present.

- Non-invasive therapy for Kidney Stones using unfocused energy and Acoustic Enhancer
- Appointed as CEO 2/2020, leading effort to launch Pivotal FDA Clinical Trial.

Founder, Member, Board of Directors, Chair of Technical Advisory Board, SiTime 8/04-11/14

- CMOS-Compatible MEMS Resonators for Electronic Products.
- SITM on Nasdaq, >$2B Market Cap, World-leading supplier of MEMS-based oscillators

CTO and Founder Cooligy, 6/02-3/05

- Liquid cooling of microprocessors and other high power-density electronic devices.

Program Manager, DARPA Microsystems Technology Office, 10/06-10/10

- Launched $250M program on Nanotechnology, Thermal Management and Nanomanufacturing.

Professor, Department of Mechanical Engineering, Stanford University, 1/94-Present

- Leading Micromechanical Systems Research Group, with emphasis on development of high-performance microsensors, and measurements of fundamental properties of microstructures.
- Active research in Micromechanical Resonators for Time References, Encapsulated Inertial Sensors, Optimal Design of MEMS Structures, Wafer-Scale Packaging of MEMS Devices.
- Teaching Mechatronics, Sensors and Measurement, and others

Staff Scientist, Technical Group Leader, Jet Propulsion Laboratory, 7/89-1/94.

- Led the design, construction, and characterization of novel micromachined Si infrared detectors magnetometers and accelerometers based on a novel displacement transducer.
- Participated in development of meterological instrumentation (pressure, wind, temperature, humidity,...), seismological instrumentation, deformable optical elements, instrumented neurological probes, soil chemistry apparatus, calibration parts for space telescopes,...

Research Assistant, Physics Department, University of California, Berkeley. 1/84-7/89.

- Measured of the heat capacity of ^{4}He submonolayers on metallic films, showing them to be in a 2-dimensional Bose gas phase, in contradiction to similar measurements on other substrates.

Honors

• Recipient	Elected to the National Academy of Engineering	2/22
• Recipient	Stanford Presidential Award for Excellence in Diversity	6/19
• Recipient	Tau Beta Pi Teaching Honor Roll	6/19
• Recipient	IEEE Daniel Noble Award for Emerging Technologies	9/18
• Recipient	IEEE Sensors Council Technical Achievement Award	9/11
• Winner	Coed Ultimate Frisbee National and World Champion	11/98, 11/99
• Recipient	NSF CAREER Award	7/95
• Recipient	R+D 100 Award	5/93
• Recipient	Distinguished Teaching Award	6/89
• Recipient	AT&T Bell Laboratories Fellowship	8/86-6/89

Litigation Experiences

- 2021 retained as Expert Witness by Apple in cases involving use of sensors for monitoring of movement of a human for training purposes, and in sensors and systems for noise cancellation. These cases are pending decisions on institution for IPR by the board.
- 2022 retained as Expert Witness by Apple to prepare IPR responses and declarations for patents related to noise cancellation. One of these cases has been instituted for IPR, and others are pending decision.
- 2020 retained as Expert Witness by Apple in multiple patents related to design of optical physiological monitors. IPRs were instituted against all thirteen challenged patents. Subsequent work included preparation and submission of reports and responses, and numerous depositions. In a string of final written decisions that issued from February through May 2022, the patent board invalidated all but one challenged claim of the thirteen patents. There is ongoing work here related to more recent patent challenges by both sides.
- 2019 retained as Expert witness in case related to wearable baby monitors, including motion and temperature sensors. Case settled during drafting of expert infringement report.
- 2018, retained as Expert witness by attorneys representing Apple in a case related to algorithms for sensing motion and other physiological parameters in wearable devices,. Case settled after going on hold for IPR evaluation of IP.
- 2016, Expert Witness in case involving optical proximity sensors in smartphones. I was retained by HTC America and Capella, who were defendants in the case. I was compensated by defendants for work involving Invalidity and Non-Infringement reports, and was deposed after expert reports on invalidity and non-infringement. This case settled just a few weeks before trial in march 2017. This was Case Action No. 2:15-cv-1524-JRG in Marshall Texas.
- 2015, Expert Witness in Mayfonk –vs- Nike patent infringement suit brought by Mayfonk. I prepared expert reports on validity and non-infringement. The case settled just before depositions were taken. I was compensated by Nike for this work. This was case # Civil No.3:14-cv-00423-MO in the District of Oregon.
- 2013-2014, Expert Witness in ST Microelectronics –vs- Invensense patent infringement suit brought in the ITC by ST. I assisted in claim construction, prepared expert reports on claim construction, validity and infringement, and provided deposition testimony. This case settled after opening statements. I was compensated by Invensense for this work. This was ITC Investigation # 337-TA-876.
- 2011-2012, Expert Witness in St. Jude Medical-vs-Volcano Corp patent infringement suit and counter suit. Assisted in claim construction, prepared expert reports, provided deposition testimony and trial testimony. I was compensated by Volcano Corporation for this work.
- 2011, Retained by Maxim Integrated Systems to examine documents and prepare opinions as to the value of certain documents in the possession of former employees of ST Microelectronics. I was compensated by Maxim for this work. This was Italian proceeding Rg. 50253/2011.

Books :

J.E. Carryer, M.Ohline and T.W. Kenny, "Introduction to Mechatronic Design", Pearson (2011).

Refereed Journal Publications:

1. J. Sun, S. Yu, H. Zhang, D. Chen, X. Zhou, C. Zhao, **D.D. Gerrard, H-K Kwon, G. Vukasin**, D. Xiao, T.W. Kenny, X. Wu, A. Seshia, "Generation and Evolution of Phononic Frequency Combs via Coherent Energy Transfer Between Mechanical Modes", Physical Review Applied 19, 014031 (2023)

2. G. Margiani, S. Guerrero, T.L Heugel, C. Marty, R. Pachlatko, T. Gisler, **G.D. Vukasin, H-K. Kwon, J.M.L. Miller, N.E. Bousse,** T.W. Kenny, O. Zilberberg, D. Sabonis, A. Eichler, "Extracting the Lifetime of a Synthetic 2-Level System", Applied Physics Letters 121, 164101 (2022).

3. **N.E. Bousse,** S.E. Kuenstner, **J.M.L. Miller, H-K. Kwon, G.D. Vukasin,** J.D. Teufel, and T.W. Kenny, "Dispersive Readout of a High-Q Micromecanical Resonator", Applied Physics Letters 121, 73503 (2022).

4. **J.M.L. Miller, G.D. Vukasin,** Z. Zhang, **H-K. Kwon**, A. Majumdar, T.W. Kenny, and S.W. Shaw, "Effect of Remote Boundary Conditions on Clamping Loss in Micromechanical Resonators", JMEMS 3, 204 (2022).

5. **J.M.L. Miller, A. Gomez-Franco, D.D. Shin, H-K Kwon**, and T.W. Kenny, "Amplitude stabilization of micromechanical oscillators using engineered nonlinearity" Physical Review Research 3, 033268 (2021).

6. S. Shin, **H-K Kwon, G.D. Vukasin**, T.W.Kenny and F. Ayazi, "A temperature compensated biaxial eFM accelerometer in Epi-seal process" Sensors and Actuators A 330, 112860 (2021).

7. Y. Wang, Y.W. Lin, **J. Glaze, G.D. Vukasin, D.D. Shin, Hyun-Keun Kwon, D.B. Heinz, Y. Chen, D.D. Gerrard**, T.W. Kenny, Andrei M Shkel, "Quantification of Energy Dissipation Mechanisms in Toroidal Ring Gyroscope", JMEMS 30, 193 (2021).

8. J.S. Katz, C. Zhang, M.T. Barako, **H.J.K. Kim**, M. Asheghi, T.W. Kenny, and K.E. Goodson, "Bicontinuous Mesoporous Metal Foams with Enhanced Conductivity and Tunable Pore Size and Porosity via Electrodeposition for Electrochemical and Thermal Systems", ACS Appl. Nano Mater. 2020, 3, 12, 12408 (2020)

9. V. Zega, G. Gattere, **S. Koppaka, A. Alter, G.D. Vukasin**, A. Frangi, and T.W. Kenny, "Numerical Modelling of Non-Linearities in MEMS Resonators", JMEMS 29, 1443 (2020).

10. **A.L. Alter, I.B. Flader, Y. Chen, L.C. Ortiz, D.D. Shin**, and T.W. Kenny, "Characterization of Accelerated Fatigue in Thick Epi-Polysilicon Vacuum Encapsulated MEMS Resonators", JMEMS 29, 1483 (2020).

11. J.S. Katz, C. Zhang, M.T. Barako, **H.J.K. Kim**, M. Asheghi, T.W. Kenny, and K.E. Goodson, "Bicontinuous Mesoporous Metal Foams with Enhanced Conductivity and Tunable Pore Size and Porosity via Electrodeposition for Electrochemical and Thermal Systems", ACS Appl. Nano Mater. 2020, 3, 12, 12408 (2020)

12. V. Zega, G. Gattere, **S. Koppaka, A. Alter, G.D. Vukasin**, A. Frangi, and T.W. Kenny, "Numerical Modelling of Non-Linearities in MEMS Resonators", JMEMS 29, 1443 (2020).

13. **A.L. Alter, I.B. Flader, Y. Chen, L.C. Ortiz, D.D. Shin**, and T.W. Kenny, "Characterization of Accelerated Fatigue in Thick Epi-Polysilicon Vacuum Encapsulated MEMS Resonators", JMEMS 29, 1483 (2020).

14. **J.M.L. Miller**, H. Zhu, S. Sundaram, **G.D. Vukasin, Y. Chen, I.B. Flader, D.D. Shin**, and T.W. Kenny, "Limits to Thermal-Piezoresistive Cooling in Silicon Micromechanical Resonators", JMEMS 29, 677 (2020).

15. **H.K. Kwon, G.D. Vukasin, N.E. Bousse,** and T.W. Kenny, "Crystal Orientation Dependent Dual Frequency Ovenized MEMS Resonator With Temperature Stability and Shock Robustness", JMEMS 29, 1130 (2020).

16. **G.D. Vukasin, V.K. Sanchez, J. Glaze, N.E. Bousse**, N. Bissel, **D.D. Shin, H.K Kwon, D. Heinz,** E.T-T Yen, and T.W. Kenny, "Anchor Design Affects Dominant Energy Loss Mechanism in a Lamé Mode MEM Resonator", JMEMS 29, 860 (2020).

17. **J.M.L. Miller, D.D. Shin, H.K. Kwon**, S.W. Shaw, and T.W. Kenny, "Spectral narrowing of parametrically pumped thermomechanical noise", Applied Physics Letters 117, 033504 (2020).

18. **A.L. Alter, I.B. Flader, Y. Chen, D.D. Shin**, and T.W. Kenny, "Nonlinear Dissipation in Epitaxial SCS and Polysilicon MEMS Driven at Large Amplitudes", JMEMS 29, 1118 (2020).

19. **N.E. Bousse, J.M.L Miller, A.L. Alter, C.P. Cameron, H.K. Kwon, G.D. Vukasin**, and T.W. Kenny, "Negative Nonlinear Dissipation in Microelectromechanical Beams", JMEMS 29, 954 (2020).

20. **A.L. Alter, D.D. Gerrard, H.K. Kwon, G.D. Vukasin**, and T.W. Kenny, "Quality Factor Extraction and Enhancement Across Temperature in Ring Resonators", JMEMS 29, 1124 (2020).

21. Z. Mohammadi, T.L. Heugel, **J.M.L. Miller, D.D. Shin, H.K. Kwon**, T.W. Kenny, R. Chitra, Oded Zilberberg, and L.G. Villanueva, "On the effect of linear feedback and parametric pumping on a resonators frequency stability", arXiv preprint arXiv:2006.00650 (2020).

22. **L.C. Ortiz, H.K. Kwon, J. Rodriguez, Y. Chen, G.D. Vukasin, D.B. Heinz, D.D. Shin**, and T.W. Kenny, "Low-Power Dual Mode MEMS Resonators With PPB Stability Over Temperature", JMEMS 29, 190 (2020).

23. **N.E. Bousse, J.M.L. Miller, H.K. Kwon, G.D. Vukasin**, and T.W. Kenny, "Quality factor tuning of micromechanical resonators via electrical dissipation", Applied Physics Letters 116, 023506 (2020).

24. X. Zhou, C. Zhao, D. Xiao, J. Sun, G. Sobreviela, **D.D. Gerrard, Y. Chen, I. Flader**, T.W. Kenny, X. Wu, and A.A. Seshia, "Dynamic modulation of modal coupling in microelectromechanical gyroscopic ring resonators", Nature Communications 10, 1 (2019).

25. **J.M.L. Miller, D.D. Shin, H.K. Kwon**, S.W. Shaw, and T.W. Kenny, "Phase Control of Self-Excited Parametric Resonators", Physical Review Applied 12 (4), 044053 (2019).

26. **J.M.L. Miller, N.E. Bousse, D.B. Heinz, H.J. Kim, H.K. Kwon, G.D. Vukasin** and T.W. Kenny, "Thermomechanical-Noise-Limited Capacitive Transduction of Encapsulated MEM Resonators", JMEMS 28, 965 (2019).

27. Y. A. Pishchalnikov, W. M. Behnke-Parks, K. Schmidmayer, K. Maeda, T. Colonius, T.W. Kenny, D.J. Laser, "High-speed video microscopy and numerical modeling of bubble dynamics near a surface of urinary stone", The Journal of the Acoustical Society of America 146, 516 (2019).

28. **I.B. Flader, Y. Chen, Y. Yang, E.J. Ng, D.D. Shin, D.B. Heinz, L. Comenencia Ortiz, A.L Alter**, W. Park, K.E. Goodson, T.W. Kenny, "Micro-Tethering for Fabrication of Encapsulated Inertial Sensors with High Sensitivity", JMEMS 28, 372 (2019).

29. **H.J. Kim, K. Kaplan**, P. Schindler, S. Xu, **M.M. Winterkorn, D. Heinz, T. English**, J, Provine, F.B. Prinz, T. Kenny, "Electrical Properties of Ultrathin Platinum Films by Plasma Enhanced Atomic Layer Deposition", ACS Applied Materials and Interfaces, 11, 9594 (2019).

30. **J. Rodriguez**, S.A.Chandorkar, C.A. Watson, G.M, Glaze, **C.H. Ahn, E.J. Ng, Y. Yang**, T.W. Kenny, "Direct Detection of Akhiezer Damping in a Silicon MEMS Resonators", Scientific Reports 9, 2244 (2019).

31. **J.M.L. Miller**, A. Ansari, **D.B. Heinz, Y. Chen, I.B. Flader, D.D. Shin**, L.G. Villanueva and T.W. Kenny, "Effective Quality Factor Tuning Mechanisms in Micromechanical Resonators", Applied Physics Reviews 5, 041307 (2018).

32. **J.M.L. Miller**, H. Zhu, **D.B. Heinz, Y. Chen, I.B. Flader, D.D. Shin**, J.E-Y. Lee, T.W. Kenny, "Thermal-Piezoresistive Tuning of the Effective Quality Factor of a MicroMechanical Resonator", Physical Review Applied, 10, 044055 (2018).

33. **J. Rodriguez**, S.A.Chandorkar, G.M, Glaze, **D.D. Gerrard, Y. Chen, D.B. Heinz, I.B. Flader**, T.W. Kenny, "Direct Detection of Anchor Damping in MEMS Tuning Fork Resonators", JMEMS 27, 1 (2018).

34. M. Mellema, W. Behnke-Parks, A. Luong, M. Hopcroft, Claire Mills, S. Ho, R. Hsi, D. Laser, T. Kenny, R. Grubbs, M. Stoller, "Absence of Ureteral/Renal Injury Following Low-Intensty Extracorporeal Acoustic Energy Lithotripsy with Stone-Targeting Microbubbles in an in-vivo Swine Model", The Journal of Urology 199,4 pe479, (2018).

35. **L. Comenencia Ortiz, D.B. Heinz, I.B. Flader, A.L. Alter, D.D. Shin, Y. Chen** and T.W. Kenny, "Assessing failure in epitaxially encapsulated micro-scale sensors using micro and nano x-ray computed tomography", MRS Communications 8, 275 (2018).

36. M.T. Barako, **T.S. English**, S. Roy-Panzer, T.W. Kenny and Kenneth E Goodson, "Dielectric barrier layers by low-temperature plasma-enhanced atomic layer deposition of silicon dioxide", Thin Solid Films 649, 24 (2018).

37. **Y. Chen, I.B. Flader, D.D. Shin, C.H. Ahn, J. Rodriguez** and T.W. Kenny, "Robust Method of Fabricating Epitaxially Encapsulated MEMS Devices with Large Gaps", JMEMS 26, 1235 (2017).

38. W. Park, **D.D. Shin**, S.J. Kim, J.S. Katz, J. Park, **C.H. Ahn**, T. Kodama, M. Asheghi, T.W. Kenny, K.E. Goodson, "Phonon Conduction in Silicon Nanobeams", Appl, Phys. Lett. 110, 213102 (2017).

39. F. Purkl, A.Daus, **T. English**, J Provine, A. Feyh, G. Urban, T. Kenny, "Measurement of Young's modulus and residual stress of atomic layer deposited Al2O3 and Pt thin films", J. Micromech. Microeng. 27, 085008 (2017)

40. G.Agarwal, T. Kazior, T. Kenny, D. Weinstein, "Modeling and analysis for thermal management in Gallium Nitride HEMTs using microfluidic cooling", Journal of Electronic Packaging 139, 11001 (2017).

41. J. Atalaya, T.W. Kenny, M.L Roukes, M.I Dykman, "Nonlinear damping and dephasing in nanomechanical systems", Physical Review B, 94, 15440 (2016).

42. O. Shoshani, **D. Heywood, Y. Yang**, T.W. Kenny, and S.W. Shaw, "Phase Noise Reduction in an MEMS Oscillator Using a Nonlinearly Enhanced Synchronization Domain", JMEMS 25 (2016).

43. **Y. Yang, E.J. Ng,** P.M. Polunin, **Y.Chen, I.B. Flader**, S.W. Shaw, M.I. Dykman, and T.W. Kenny, "Nonlinearity of Degenerately Doped Bulk-Mode Silicon MEMS Resonators", JMEMS 25, 859 (2016).

44. **T.S. English**, J Provine, A.F. Marshall, A.L. Koh, T.W. Kenny, "Parallel preparation of plan-view transmission electron microscopy specimens by vapor-phase etching with integrated etch stops", Ultramicroscopy 166, 39 (2016).

45. **Y. Yang, E.J. Ng, Y. Chen, I.B. Flader**, T.W. Kenny, "A Unified Epi-Seal Process for Fabrication of High-Stability Microelectromechanical Devices", JMEMS 25, 489 (2016).

46. **D.B. Heinz, V.A. Hong, C.H. Ahn, E.J. Ng, Y. Yang**, and T.W. Kenny, "Experimental Investigation into Stiction Forces and Dynamic Mechanical Anti-Stiction Solutions in Ultra-Clean Encapsulated MEMS Devices", JMEMS 25, 469 (2016)

47. P.M. Polunin, **Y. Yang**, M.I. Dykman, T.W. Kenny, and S.W. Shaw, "Characterization of MEMS Resonator Nonlinearities Using the Ringdown Response", JMEMS 25, 297 (2016).

48. **C.H. Ahn, E.J Ng, V.A Hong, J. Huynh, S. Wang**, and T.W. Kenny, "Characterization of Oxide-Coated Polysilicon Disk Resonator Gyroscope Within a Wafer-Scale Encapsulation Process", JMEMS 24, 1687 (2015).

49. B.W. Soon, Y. Qian, **E.J. Ng, V.A. Hong, Y. Yang, C.H. Ahn**, T.W. Kenny, and C. Lee, "Investigation of a Vacuum Encapsulated Si-to-Si Contact Microswitch Operated From− 60° C to 400° C", JMEMS 24 1906, (2015).

50. **Y. Won**, Y. Gao, R. Guzman de Villoria, B.L. Wardle, R. Xiang, S. Maruyama, T.W. Kenny, and K.E. Goodson, "Nonhomogeneous morphology and the elastic modulus of aligned carbon nanotube films", Journal of Micromechanics and Microengineering 25, 115023 (2015).

51. M.T Barako, S. Roy-Panzer, T.S. English, T. Kodama, M. Asheghi, T.W. Kenny, and K.E. Goodson, "Thermal Conduction in Vertically Aligned Copper Nanowire Arrays and Composites", ACS Applied Materials and Interfaces, 34, 19251 (2015).

52. V. Zega, S.H. Nitzan, M. Li, **C.H. Ahn, E. Ng, V. Hong, Y.Yang**, T.W. Kenny, A. Corigliano, and D.A. Horsley, "Predicting the closed-loop stability and oscillation amplitude of nonlinear parametrically amplified oscillators", Appl. Phys. Lett. 106, 233111 (2015).

53. S.H. Nitzan, V. Zega, M. Li, **C.H. Ahn**, A. Corigliano, T.W. Kenny and D.A. Horsley, "Self-Induced Parametric Amplification arising from Nonlinear Elastic Coupling in a Micromechanical Resonating Disk Gyroscope", Scientific Reports 5:9036 (2015)

54. **C.H. Ahn, E.J. Ng, V.A. Hong, Y.Yang, B. Lee, I. Flader** and T.W. Kenny, "Mode-Matching of Wineglass-Mode Disk Resonator Gyroscope in (100) Single Crystal Silicon", JMEMS 24, 343 (2015).

55. **V.A. Hong, S. Yoneoka, M.W. Messana, A.B. Graham, J.C. Salvia, T.T. Branchflower, E.J. Ng** and T.W. Kenny, "Fatigue Experiments on Single-Crystal Silicon in an Oxygen-Free Environment", JMEMS 24, 351 (2015).

56. **E.J. Ng, V.A. Hong, Y. Yang, C.H. Ahn, C.L.M. Everhart** and T.W. Kenny, "Temperature Dependence of the Elastic Constants of Doped Silicon", JMEMS 24 730, (2015)

57. C.L. Roozeboom, B.E. Hill, **V.A. Hong, C.H. Ahn, E.J. Ng, Y. Yang**, T.W. Kenny, M.A. Hopcroft and B.L. Pruitt, "Multifunctional Integrated Sensors for MultiParameter Monitoring Applications", JMEMS 24, (2015).

58. **S. Ghaffari, E.J. Ng, C.H. Ahn, Y.Yang, S. Wang, V.A. Hong**, and T.W. Kenny, "Accurate Modeling of Quality Factor Behavior of Complex MEMS Resonators", JMEMS 24, 276 (2015)

59. **C.H. Ahn**, S. Nitzan, **E.J. Ng, V.A. Hong, Y. Yang, T. Kimbrell**, D.A. Horsley, and T.W. Kenny, "Encapsulated High Frequency (235 kHz), High-Q (100k) Disk Resonator Gyroscope with Electrostatic Parametric Pump", Applied Physics Letters, 105, 243504 (2014).

60. B.W. Soon, **E.J. Ng, V.A. Hong, Y. Yang, C.H. Ahn**. Y. Quan, T.W. Kenny and C. Lee, "Fabrication and Characterization of a Vacuum-Encapsulated Curved Beam Switch for Harsh Environment Application", JMEMS 23, 1121 (2014).

61. Y.Won, Y. Gao, M.A. Panzer, R.Xiang, S. Maruyama, T.W. Kenny, W. Cai, and K.E. Goodson, "Zipping, entanglement, and the Elastic Modulus of Aligned Single-Walled Carbon Nanotube Films", Proceedings of the National Academy of Sciences, 110, 20426 (2013).

62. **M.A. Philippine**, H. Zareie, O. Sigmund, G.M. Rebeiz, and T.W. Kenny, "Experimental Validation of Topology Optimization for RF MEMS Capacitive Switch Design", JMEMS 22, 1296 (2013).

63. **S. Ghaffari, S.A. Chandorkar, S. Wang, E.J. Ng, C.H Ahn, V. Hong, Y. Yang**, and T.W. Kenny, "Quantum Limit of Quality Factor in Silicon Micro and Nano Mechanical Resonators", Scientific Reports, 3:3244 (2013).

64. M. Li, **E.J. Ng, V.A. Hong, C.H. Ahn, Y. Yang**, T.W. Kenny and D.A. Horsley, "Lorentz Force Magnetometer using a Micromechanical Oscillator", Appl. Phys. Lett 103, (2013)

65. **H.K. Lee, R. Melamud, B. Kim, S. Chandorkar, J.C. Salvia** and T.W. Kenny, "The effect of Temperature-Dependent Nonlinearities on the Temperature Stability of Micromechanical Resonators", J. Appl. Phys. 114, (2013)

66. R.G. Hennessy, M.M. Shulaker, **M. Messana, A.B. Graham**, N. Klewa, J. Provine, T.W. Kenny and R.T. Howe, "Vacuum Encapsulated Resonators for Humidity Measurement", Sensors and Actuators B-Chemical 185, 575 (2013)

67. **S. Ghaffari, C.H. Ahn, E.J. Ng, S. Wang** and T.W. Kenny, "Crystallographic Effects in Modeling Fundamental behavior in MEMS Silicon Resonators", Microelectronics Journal 44, 586 (2013)

68. **E. Ng, H-K Lee, C-H Ahn, R. Melamud** and T.W. Kenny, "Stability of Silicon Microelectromechanical Systems Resonant Thermometers", IEEE Sensors 13, (2013).

69. **M.A. Philippine**, O. Sigmund, G.M Rebeiz, and T.W. Kenny, "Topology Optimization of Stressed Capacitive RF MEMS Switches," JMEMS 22, 206 (2013).

70. J.C. Duda, **T.S. English**. E.S. Piekos, T.E. Beechem, T.W. Kenny and P.E. Hopkins, "Bidirectionality tuning Kapitza conductance through the inclusion of Substitutional Impurities", J. Appl. Phys 112, (2012).

71. **S. Yoneoka**, J. Lee, M. Liger, G. Yama, T. Kodama, M. Gunji, R.T. Howe, K.E. Goodson and T.W. Kenny, "Electrical and Thermal Conduction in Atomic Layer Deposition Nanobridges down to 7nm Thickness", NanoLett, 12 (2) 683 (2012).

72. **Y. Won**, J.Lee, M. Asheghi, T.W. Kenny, and K.E. Goodson "Phase and thickness dependent modulus of $Ge_2Sb_2Te_5$ films down to 25 nm thickness", Appl. Phys. Lett 100, 161905 (2012).

73. **Y. Won**, Y. Gao. M.A. Panzer, S. Dogbe, L. Pan, T.W. Kenny, and K.E. Goodson, "Mechanical Characterization of Aligned Milti-Walled Carbon Nanotube Films using Microfabricated Resonators", Carbon 50, 347 (2012)

74. **H.K. Lee, R. Melamud, S. Chandorkar, J.G. Salvia, S. Yoneoka** and T.W. Kenny, "Stable Operation of MEMS Oscillators Far Abve the Critical Vibration Amplitude in the Nonlinear Regime", JMEMS Letters 20,1228 (2011).

75. K.P. Bloschock, A.R. Schofield, and T.W Kenny, "Tip-Based Nanofabrication : An Approach to True Nanotechnology", Proceedings of the SPIE 8031, 803102 (2011).

76. **H.K. Lee, R. Melamud, B. Kim, M.A. Hopcroft, J.G. Salvia**, and T.W. Kenny, "Electrostatic Tuning to Achieve Higher Stability Micromechanical Composite Resonators", JMEMS 20, 1355 (2011).

77. **G. Bahl, S. Wang, J.C. Salvia, R. Melamud**, R.T. Howe and T.W. Kenny, "AC Polarization for Charge-Drift Elimination in Resonant Electrostatic MEMS and Oscillators", IEEE JMEMS 20, 355-364 (2011).

78. **H.K. Lee, B. Kim, R. Melamud, M.A. Hopcroft, J.C. Salvia and T.W. Kenny, "**Influence of the Temperature-Dependent Nonlinearities on the Performance of Micromechanical Resonators", Appl. Phys. Lett 99, 194102 (2011).

79. **Y. Won, E.N. Wang,** K.E. Goodson and T.W. Kenny, "3-D Visualization of Flow in Microscale Jet Impingement Systems", International Journal of Thermal Sciences, 50, 325 (2011).

80. **K-L. Chen, S. Wang, J.C. Salvia. R. Melamud** R.T. Howe and T.W. Kenny, "Wafer-Level Epitaxial Silicon Packaging for Out-of Plane RF MEMS Resonators with Integrated Actuation Electrodes", IEEE Transactions on Components, Packaging and Manufacturing Technology Vol 1, 310-317 (2011).

81. **G. Hill, D. Soto**, A. Peattie, R.J. Full, T.W. Kenny, "Orientation angle and the adhesion of single gecko setae", Journal of the Royal Society Interface, Vol 8 926-933 (2011).

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DARPA Program Manager Portfolio (10/1/06 – 9/30/10)

DARPA MIATA Program (MicroAntenna Arrays – Technology and Applications).

- $40M Program Launched by Henryk Temkin in 2005
- Focused on microfabricated antennas for mm-wave radiation sensors, and on integration of antenna, sensor, amplifier and readout circuitry in same structure

DARPA TGP Program (Thermal Ground Plane).

- $50M Program Launched by Thomas Kenny in 2007
- Focused on microfabricated vapor chamber chamber heat spreaders with reduced dimensions, increased performance, and circuit-compatible materials

DARPA YFA Program (Young Faculty Award).

- $7M/year Program Launched by Henryk Temkin in 2006, re-run in 2007 and 2008.
- Provided small ($200K) grants to promising young faculty throughout the US with ideas and interests that could lead to new technologies for the DoD.

DARPA TBN Program (Tip-Based Nanofabrication)

- $50M Program Launched by Thomas Kenny in 2007
- Focused on controlled nanofabrication, with emphasis on controlling the size, shape, location and other properties of every nanostructure formed on a surface.

DARPA MACE Program (Microtechnologies for Air-Cooled Exchangers).

- $35M Program Launched by Thomas Kenny in 2008
- Focused on use of microtechnologies in air-cooled heat exchangers

DARPA NTI Program (NanoThermal Interfaces).

- $30M Program Launched by Thomas Kenny in 2009
- Focused on development of new nanostructured materials for enhanced thermal interfaces for electronics cooling.

DARPA CEE Program (Casimir Effect Enhancement).

- $10M Program Launched by Thomas Kenny in 2010
- Focused on demonstration of reduced adhesion at the nanoscale through the use of the Casimir effect

DARPA ACM Program (Active Cooling Modules).

- $30M Program Launched by Thomas Kenny in 2010)
- Focused on development of complete, high-performance cooling modules based on thermoelectric refrigeration, vapor compression refrigeration, and other novel refrigeration concepts.

DARPA NJTT Program (Near-Junction Thermal Transport).

- $25M Program Formulated by Thomas Kenny in 2010, Launched by Avram Bar-Cohen in 2011
- Program focus is on enhanced thermal conduction in the region immediately beneath the hot spots in high-power electronic devices.

DARPA "Seedlings" ($250K efforts to prove key initial pieces of technology)

- ~20 projects solicited, launched and managed
- Produced important early results for TGP, TBN, NTI and ACM programs.

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