

**NANCY A. BURNHAM**  
**2011**

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**INTERESTS:** Mechanical properties of nanostructures; instrumentation, metrology for nanomechanics

**RESEARCH EXPERIENCE:**

**As of 2000:** Associate Professor of Physics, Worcester Polytechnic Institute, Worcester MA. Adhesion of microsensor surfaces, interpretation of force curves of tissue-growth substrates and of microbial exopolymers, precision and accuracy of Atomic-Force Microscopy data.

**1994-99:** Fonctionnaire Scientifique, puis Professeure Invitée, à l'Ecole Polytechnique Fédérale de Lausanne. Friction on 2-D self-organized systems (*Science*), elasticity of carbon nanotubes (*Phys. Rev. Lett.*), rheology of polymer blends. Invented Scanning Local-Acceleration Microscopy as a high-resolution technique to quantitatively measure local materials properties including nonlinear effects leading to nanoscale chaotic behavior (*Phys. Rev. Lett.*, a commercially available product). Numerical simulations of nonlinear dynamic tip-sample interactions. Organized the Nanomechanics Lab and Group.

**1991-93:** Alexander-von-Humboldt Stipendiatin beim Institut der Schicht- und Ionentechnik der Forschungszentrum Jülich GmbH, Deutschland. Discovered patch charges as an origin of surface forces (*Phys. Rev. Lett.*). Built a UHV and an ambient atomic force microscope (AFM).

**1987-91:** National Research Council Postdoctoral Fellowship at the Naval Research Laboratory Chemistry Department, Washington DC, USA. Measured nanomechanical properties and surface forces of materials (*US patent*). Demonstrated that AFM is sensitive to small changes in the chemistry of monolayers (*Phys. Rev. Lett.*). Compared AFM adhesion data of metal surfaces with molecular dynamics simulations (*Science*). Two Chemistry Division Awards for Superior Technical Publication - 1990, 1991.

**Graduate work 1980-87:** National Renewable Energy Laboratory, Golden CO, and University of Colorado at Boulder, USA. Surface analysis, hall measurements, and optical spectroscopy of semiconductors. Dissertation: Determined changes in the core levels and valence band of hydrogenated amorphous silicon as a function of hydrogen concentration using surface analysis techniques.

**TEACHING EXPERIENCE:**

**Previous to WPI:** At Colgate, Physics Department Award for excellence in tutoring undergraduates. At EPFL, English tutor for a mailing list of 700 people ([http://nanomechanics.com/sci\\_eng](http://nanomechanics.com/sci_eng)) and laboratory instructor for up to sixty undergraduates per session (*en français oder auf Deutsch* or in English). At Royal Institute of Technology in Stockholm, a twenty-hour graduate course in Nanomechanics.

**At WPI:** Introductory (400 students) and intermediate (40 students) mechanics using cooperative-group problem solving and computer homework, in addition to traditional physics homework and lab development for computerized laboratories. Writing a textbook for and developing a course in atomic force microscopy, PH2510, partially funded by NSF NUE program. Year-long undergraduate projects.

### INVENTIONS:

1. [43, GS] “**Mechanical and Surface Force Nanoprobe**”, N.A. Burnham and R.J. Colton, US Patent Number 5,193,383, issued March 16, 1993. Licence issued, more under negotiation.
2. “Scanning Local-Acceleration Microscopy”, July 1995, now marketed as the Materials Analysis Package from Park Scientific Instruments.

### RECOGNITION:

1. National Research Council Postdoc, Naval Research Laboratory, Washington DC, USA, 1987-91.
2. Alexander von-Humboldt Stipendiatin, Forschungszentrum Jülich GmbH, Deutschland, 1991-94.
3. Professeure invitée, Centre de Physique Moléculaire et d’Optique, Université Bordeaux, 1996.
4. Visiting Research Scholar, Tokyo Institute of Technology, July 1999.
5. Visiting Prof., Engineering Materials Physics, Royal Institute of Technology, Stockholm, fall 1999.
6. Nanotechnology Recognition Award, Nanoscale Science and Technol. Division of the AVS, 2001.
7. Insitute of Physics of Ireland Lecturer, October 2002.
8. Nominated by a student for inclusion in *Who’s Who Among America’s Teachers*, April 2005.
9. Meritorious Achievement as an Advisor to senior research projects, 2003, 2006, 2007, 2009.
10. Nominated for Young Faculty Award for Innovation in Undergraduate Education, 2003, 2005, 2006.
11. Fellow of AVS, 2010, “*For technical leadership in areas of nanoscience and nanotechnology, especially for contributions in scanning probe microscopy and nanomechanics.*”

### PROFESSIONAL ACTIVITIES:

1. Organizer, European project meeting on Atomic Force Microscopy and Micro-acoustics, April 1995.
2. Local Arrangements Committee for STM’95, an international meeting with 585 participants.
3. Co-organizer, Fundamentals of Nanoindentation and Nanotribology, MRS Spring Meeting, 1998.
4. Treasurer, Nanoscale Science and Technology Division of the AVS (1400 members) since 2002.
5. Program Committee, International AVS Symposia since 2002.
6. NSTD Representative to IUUVSTA, an international committee on vacuum science, 2004-2010. Elected to Divisional (executive) Committee.
7. Steering Committee, International Conference on Nanoscience and Technology 2006-08.
8. Editorial Board, Journal of Vacuum Science and Technology, 2007-13.
9. Reviewer for NSF, NIH, DOE, funding agencies for Ireland and United Kingdom, **Journals (2008 ISI Impact Factor, bold if over 5):** ACS Applied Materials and Interfaces (new), ACS Nano (5.472), Acta Biomaterialia (3.727), Acta Mechanica (1.297), Applied Physics Letters (3.726), CRC Press, European Physical Journal E (1.943), IEEE Transactions on Education (1.400), International Organization for Standardization, Israel J. Chemistry (0.467), J. Applied Physics (2.201), J. Materials Research (1.743), J. Materials Science (1.181), J. Physical Chemistry B (4.189), J. Vacuum Science and Technology A (1.173) and B (1.445), Langmuir (4.097), Measurement Science and Technology (1.493), Microporous and Mesoporous Materials (2.555), MRS Proceedings, Nanotechnology (3.446), **Nature Nanotechnology (20.588)**, **Physical Review B (3.322)**, E (2.508), and **Letters (7.180)**, Proceedings of the Royal Society A (1.705), **Science (28.103)**, **Small (6.525)**, Smart Materials and Structures (1.743), Surface Science (1.731), Tribology Letters (1.385), Ultramicroscopy (2.629).

**EDUCATION:** May 1987, Ph.D., Physics (M.S. December 1985), University of Colorado at Boulder.  
May 1980, B.A. Physics, Colgate University, Hamilton NY, USA.

**AFFILIATIONS:** Materials Research Society, American Vacuum Society, Sigma Xi, Sigma Pi Sigma.

**LANGUAGES:** Native English, good French and German, tourist level Italian, Swedish, and Dutch.

## NANCY A. BURNHAM

### Publications

2011

Names of publications with 27 or more citations are in **bold**. Names of publications in journals with impact factors over five are in *italics*. My total citations equal 4436 and my h-index equals 27, as of January 2011. [Citations, Impact Factor, Source] proceeds each reference, with ISI = Institute of Scientific Information or GS = Google Scholar. 2008 impact factors are from ISI exclusively.

#### JOURNAL PUBLICATIONS:

1. [12, 1.173, ISI] “Auger Analysis of Si-H Bonding and Hydrogen Concentration in Hydrogenated Amorphous Silicon,” A.J. Nelson, N.A. Burnham, A.B. Swartzlander, S.E. Asher, and L.L. Kazmerski, *J. Vac. Sci. Technol.* **A4**, 1570-73 (1986).
2. [1, 1.173, ISI] “Scanning Auger Microprobe Studies of Ball-Cratered CdS/CuInSe<sub>2</sub> Solar Cells,” L.L. Levenson, N.A. Burnham, R.J. Matson, and L.L. Kazmerski, *J. Vac. Sci. Technol.* **A4**, 1680-83 (1986).
3. [4, 2.788, ISI] “Auger Line-Shape Analysis of Hydrogenated Amorphous Silicon,” N.A. Burnham, A.J. Nelson, A.B. Swartzlander, and L.L. Kazmerski, *Solar Cells* **21**, 135-40 (1987).
4. [4, 1.173, ISI] “EELS Study of Hydrogenated Amorphous Silicon,” N.A. Burnham, R.F. Fisher, S.E. Asher, and L.L. Kazmerski, *J. Vac. Sci. Technol.* **A5**, 2016-18 (1987).
5. [7, 1.173, ISI] “Electron Beam Effects in the Analysis of Compound Semiconductors and Devices,” L.L. Kazmerski, N.A. Burnham, A.B. Swartzlander, A.J. Nelson, and S.E. Asher, *J. Vac. Sci. Technol.* **A5**, 2814-18 (1987).
6. [359, 1.173, ISI] “**Measuring the Nanomechanical Properties and Surface Forces of Materials Using an Atomic Force Microscope**,” N.A. Burnham and R.J. Colton, *J. Vac. Sci. Technol.* **A7**, 2906-13 (1989).
7. [155, 1.173, ISI] “**On the Electrochemical Etching of Tips for Scanning Tunneling Microscopy**,” J.P. Ibe, S.L. Brandow, R.A. Brizzolara, N.A. Burnham, D.P. DiLella, K.P. Lee, C.R.K. Marrian, and R.J. Colton, *J. Vac. Sci. Technol.* **A8**, 3570-75 (1990).
8. [230, 7.180, ISI] “*Probing the Surface Forces of Monolayer Films with an Atomic Force Microscope*,” N.A. Burnham, D.D. Dominguez, R.L. Mowery, and R.J. Colton, *Phys. Rev. Lett.* **64**, 1931-34 (1990).
9. [713, 28.103, ISI] “*Atomistic Mechanisms and Dynamics of Adhesion, Nanoindentation and Fracture*,” U. Landman, W.D. Luedtke, N.A. Burnham, and R.J. Colton, *Science* **248**, 454-61 (1990).
10. [115, 1.173, ISI] “**Interpretation Issues in Force Microscopy**,” N.A. Burnham, R.J. Colton and H.M. Pollock, *J. Vac. Sci. Technol.* **A9**, 2548-56 (1991).
11. [57, 7.180, ISI] a) “*Work Function Anisotropies as an Origin of Long-Range Surface Forces*,” N.A. Burnham, R.J. Colton and H.M. Pollock, *Phys. Rev. Lett.* **69**, 144-47 (1992), and [2, 7.180, ISI] b) “*Burnham, Colton and Pollock Reply*,” *Phys. Rev. Lett.* **70**, 247 (1993).
12. [190, 3.446, GS] “**Interpretation of Force Curves in Force Microscopy**,” N.A. Burnham, R.J. Colton and H.M. Pollock, *Nanotechnol.* **4**, 64-80 (1993).
13. [15, 3.726, ISI] “Apparent and True Feature Heights in Force Microscopy,” N.A. Burnham, *Appl. Phys. Lett.* **63**, 114-16 (1993).
14. [8, 1.445, ISI] “Accounting for the Stiffnesses of the Probe and Sample in Scanning Probe Microscopy,” N.A. Burnham, *J. Vac. Sci. Technol.* **B12**, 2219-21 (1994).
15. [14, 0.685, ISI] “Attractive Forces Between Micron-Sized Particles: A Patch Charge Model”, H.M. Pollock, N.A. Burnham and R.J. Colton, *J. Adhesion* **51**, 71-86 (1995).
16. [75, 7.180, ISI] “*Nanosubharmonics: The Dynamics of Small Nonlinear Contacts*”, N.A. Burnham, A.J. Kulik, G. Gremaud and G.A.D. Briggs, *Phys. Rev. Lett.* **74**, 5092-95 (1995).

17. [104, 1.445, ISI] “**Scanning Local-Acceleration Microscopy**”, N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, *J. Vac. Sci. Technol.* **B14**, 794-99 (1996).
18. [104, 1.445, GS] “**Materials’ Properties Measurements: Choosing the Optimal SPM Configuration**”, N.A. Burnham, G. Gremaud, A.J. Kulik, P.-J. Gallo and F. Oulevey, *J. Vac. Sci. Technol.* **B14**, 1308-12 (1996).
19. [7, 3.446, ISI] “Electrical-Conductivity SFM Study of an Ultrafiltration Membrane,” P.-J. Gallo, A.J. Kulik, N.A. Burnham, F. Oulevey and G. Gremaud, *Nanotechnol.* **8**, 10-13 (1997).
20. [196, 3.446, ISI] “**How does a Tip Tap?**,” N.A. Burnham, O.P. Behrend, F. Oulevey, G. Gremaud, P.-J. Gallo, D. Gourdon, E. Dupas, A.J. Kulik, H.M. Pollock and G.A.D. Briggs, *Nanotechnol.* **8**, 67-75 (1997).
21. [53, 4.097, ISI] “**Uniformly Flat Gold Surfaces: Imaging the Domain Structure of Organic Monolayers Using Scanning Force Microscopy**,” D. Stamou, D. Gourdon, M. Liley, N.A. Burnham, A.J. Kulik, H. Vogel, and C. Duschl, *Langmuir* **13**, 2425-28 (1997).
22. [21, 1.385, GS] “The Dependence of Friction Anisotropies on the Molecular Organisation of LB films as Observed by AFM,” D. Gourdon, N.A. Burnham, A.J. Kulik, E. Dupas, F. Oulevey, G. Gremaud, D. Stamou, M. Liley, Z. Dienes, H. Vogel and C. Duschl, *Tribol. Lett.* **3**, 317-24 (1997).
23. [40, 1.738, ISI] “**Local Mechanical Spectroscopy with Nanometer Scale Lateral Resolution**,” F. Oulevey, G. Gremaud, A. Sémoroz, A.J. Kulik, N.A. Burnham, E. Dupas and D. Gourdon, *Rev. Sci. Instruments* **69**, 2085-94 (1998).
24. [26, 1.884, ISI] “Intermittent Contact: Tapping or Hammering?,” O.P. Behrend, F. Oulevey, D. Gourdon, E. Dupas, A.J. Kulik, G. Gremaud and N.A. Burnham, *Appl. Phys.* **A66**, S219-21 (1998).
25. [68, 28.103, ISI] “**Friction Anisotropy and Asymmetry of a Compliant Monolayer Induced by a Small Molecular Tilt**”, M. Liley, D. Gourdon, D. Stamou, U. Meseth, T.M. Fischer, C. Lautz, H. Stahlberg, H. Vogel, N.A. Burnham and C. Duschl, *Science* **280**, 273-75 (1998).
26. [240, 8.191, GS] “**Elastic Modulus of Ordered and Disordered Multiwalled Carbon Nanotubes**”, J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.M. Bonard, T. Stöckli, K. Méténier, S. Bonnamy, F. Béguin, N.A. Burnham and L. Forró, *Adv. Mat.* **11**, 161-65 (1999).
27. [728, 7.180, GS] “**Elastic and Shear Moduli for Single-Walled Carbon Nanotube Ropes**”, J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.M. Bonard, N.A. Burnham and L. Forró, *Phys. Rev. Lett.* **82**, 944-47 (1999).
28. [51, 3.446, ISI] “**Phase Imaging: Deep or Superficial?**” O.P. Behrend, L. Odoni, J.L. Loubet and N.A. Burnham, *Appl. Phys. Lett.* **75**, 25551-53 (1999).
29. [33, 3.726, GS] “**Dynamic Mechanical Analysis at the Submicron Scale**”, F. Oulevey, N.A. Burnham, G. Gremaud, A.J. Kulik, H.M. Pollock, A. Hammiche, M. Reading, M. Song and D.J. Hourston, *Polymer* **41**, 3087-92 (2000).
30. [8, 2.887, GS] “Martensitic Transformation of NiTi Studied at the Nanometer Scale by Local Mechanical Spectroscopy”, F. Oulevey, G. Gremaud, D. Mari, A.J. Kulik, N.A. Burnham and W. Benoit, *Scripta Mat.* **42**, 31-36 (2000).
31. [21, 1.743, GS] “A Model for Materials Properties Nanoprobes”, N.A. Burnham, S.P. Baker and H.M. Pollock, *J. Mat. Research* **15**, 2006-14 (2000).
32. [41, 1.731, ISI] “**Optimizing Phase Imaging via Dynamic Force Curves**”, X. Chen, M.C. Davies, C.J. Roberts, S.J.B. Tendler, P.W. Williams, and N.A. Burnham, *Surf. Sci.* **460**, 292-300 (2000).
33. [0, 1.738, ISI] “Apparatus for Illuminating the Tip-Sample Interface of an AFM”, E.J. Thoreson and N.A. Burnham, *Rev. Sci. Instruments* **74**, 94-99 (2003).
34. [141, 3.446, ISI] “**Comparison of Calibration Methods for Atomic-Force Microscopy Cantilevers**”, N.A. Burnham, X. Chen, C.S. Hodges, G.A. Matei, E.J. Thoreson, C.J. Roberts, M.C. Davies, and S.J.B. Tendler, *Nanotechnol.* **14**, 1-6 (2003).
35. [7, 1.738, ISI] “Standard-Deviation Minimization for Calibrating the Radii of Spheres Attached to AFM Cantilevers”, E.J. Thoreson and N.A. Burnham, *Rev. Sci. Instruments* **75**, 1359-1362 (2004).

36. [39, 1.738, GS] “**Precision and accuracy of thermal calibration of atomic force microscopy cantilevers**”, G.A. Matei, E.J. Thoreson, J.R. Pratt, D.B. Newell, and N.A. Burnham, *Rev. Sci. Instruments* **77**, 083703 (2006).
37. [14, 2.443, ISI] “The role of few-asperity contacts in adhesion”, E. J. Thoreson, J. Martin, and N. A. Burnham, *J. Colloid Interface Science* **298**, 94-101 (2006).
38. [80, 4.683, GS] “**Substrate rigidity regulates the formation and maintenance of tissues,**” W.H. Guo, M.T. Frey, N.A. Burnham, and Y.L. Wang, *Biophys. J.* **90**, 2213-20 (2006).
39. [2, 2.226, ISI] “Recommendations for the use of an Atomic Force Microscope as an in-fab stiction monitor,” E. J. Thoreson, J. Martin, and N. A. Burnham, *J. MEMS* **16**, 694-699 (2007).
40. [7, 3.726, ISI] “Optimal roughness for minimal adhesion”, D.-L. Liu, J. Martin, and N.A. Burnham, *Appl. Phys. Lett.* **91**, 043107 (2007).
41. [6, 5.712, ISI] “*Effect of electrode roughness on the capacitive behavior of self-assembled monolayers*”, E.F. Douglas, P.F. Driscoll, D. Liu, N.A. Burnham, C.R. Lambert, and W.G. McGimpsey, *Anal. Chem.* **80**, 7670-77 (2008).
42. [3, 3.160, ISI] “Atomic force microscopy study of the role of LPS O-antigen on adhesion of *E. coli*”, J. Strauss, N.A. Burnham, and T.A. Camesano, *J. Mol. Recognit.* **22**, 347-355, (2009) 10.1002/jmr.955.
43. [1, 2.201, GS] “Quantitative assessment of sample stiffness and sliding friction from force curves in atomic force microscopy”, J.R. Pratt, G. Shaw, L. Kumanchik, and N.A. Burnham, *J. Applied Phys.* **107**, 044305 (2010).
44. [0, 0.869, ISI] “Which fractal parameter contributes most to adhesion?” D.-L. Liu, J. Martin, and N.A. Burnham, *J. Adhesion Sci. Technol.* **24**, 2383-96 (2010).
45. [0, 3.94] “Relating the physical properties of *Pseudomonas aeruginosa* lipopolysaccharides to virulence using atomic force microscopy”, I.E. Ivanov, E.N. Kintz, J.B. Goldberg, N.A. Burnham, and T.A. Camesano, *J. Bacteriology*, accepted November 2010.
46. [0, 6.52] “Shape-independent lateral force calibration,” E.V. Anderson, S. Chakraborty, T. Esformes, D. Eggiman, C. DeGraf, K. Stevens, D. Liu, and N.A. Burnham, submitted to *Small*, 26 January 2010.

#### **BOOK CHAPTERS AND BOOKS:**

1. [29, GS] “**Force Microscopy**”, by N.A. Burnham and R.J. Colton, pp. 191-249, in Scanning Tunneling Microscopy and Spectroscopy: Theory, Techniques and Applications, D.A. Bonnell (ed.), VCH Publishers, New York (1993).
2. “Attractive Forces Between Micron-Sized Particles: A Patch Charge Model”, H.M. Pollock, N.A. Burnham and R.J. Colton, in Advances in Particle Adhesion, D.S. Rimai and L.H. Sharpe, eds., Gordon and Breach (1996).
3. [81, GS] “**Tip-Surface Interactions**”, N.A. Burnham, A.J. Kulik and G. Gremaud, in Procedures in Scanning Probe Microscopy, R.J. Colton et al., eds., pp. 565-84, John Wiley and Sons, Chichester (1998).
4. [13, GS] Fundamentals of Nanoindentation and Nanotribology, N.R. Moody, W.W. Gerberich, N. Burnham and S.P. Baker, eds., Vol. 522, Materials Research Society Symposium Proceedings (1998).
5. [41, GS] “**Surface Forces and Adhesion,**” N.A. Burnham and A.J. Kulik, in Handbook of Micro/Nanotribology, pp. 247-71, B. Bhushan, ed., 2<sup>nd</sup> edition, CRC Press, Boca Raton, FL, USA (1999).
6. [208, GS] “**Nanomechanics,**” N.A. Burnham and R.J. Colton, in Scanning Probe Microscopy and Spectroscopy: Theory, Techniques and Applications, pp.337-69, D.A. Bonnell (ed.), 2<sup>nd</sup> edition, Wiley-VCH Publishers, New York (2001).
7. Atomic Force Microscopy, A Physical Introduction, N.A. Burnham, Springer Verlag (2011).

## PROCEEDINGS PUBLICATIONS:

1. “Core and Valence Levels in Hydrogenated Amorphous Silicon,” N.A. Burnham, R.F. Fisher, S.E. Asher, L.L. Kazmerski, G. Lucovsky, and G.N. Parsons, *Mat. Res. Soc. Symp. Proc.* Vol. **77**, 691-96 (1987).
2. “Analysis of CuInSe<sub>2</sub>: Electron and Ion Beam Effects,” A.J. Nelson, N.A. Burnham, A.B. Swartzlander, S.E. Asher, and L.L. Kazmerski, *Proceedings of the 19th IEEE Photovoltaic Specialists Conference (A88-34226 13-44)*, IEEE New York (1987).
3. “A Continuum Model for Force Microscopy Force Curve Data,” N.A. Burnham, *Computations for the Nano-Scale, NATO ASI Series E240*, Kluwer Academic, 199-207 (1993).
4. [8, GS] “Mechanical Properties Studied at the Nanoscale Using Scanning Local-Acceleration Microscopy”, F. Oulevey, N.A. Burnham, A.J. Kulik, P.-J. Gallo, G. Gremaud and W. Benoit, 11th International Conference on Internal Friction and Ultrasonic Attenuation in Solids, *J. de Physique IV, Colloque C8, supplément au J. de Physique III, Volume 6, December 1996*, pp. C8 731-34.
5. [4, GS] a) “A Beginner’s Guide to LPM Materials Properties Measurements. Part I: Conceptual Aspects”; and  
b) “A Beginner’s Guide to LPM Materials Properties Measurements. Part II: Experimental Aspects”, N.A. Burnham, A.J. Kulik, F. Oulevey, C. Mayencourt, D. Gourdon, E. Dupas and G. Gremaud, in “Micro/Nanotribology and Its Applications”, B. Bhushan, ed., *NATO ASI Series E330*, Kluwer Academic (1997) pp. 421-54.
6. [6, 0.608, ISI] “Stiffness of Measurement System and Significant Figures of Displacement which are Required to Interpret Adhesion Force Curves”, K. Takahashi, N.A. Burnham, H. M. Pollock, and T. Onzawa, *IEICE Trans. Electron.* **E80-C**, 255-62 (1997).
7. [1, GS] “Phase Transitions in Polymers: Towards Dynamic Mechanical Analysis with Submicron Spatial Resolution”, F. Oulevey, A. Hammiche, H.M. Pollock, N.A. Burnham, M. Song, D.J. Hourston and M. Reading, *European Physical Society Europhysics Conference Abstracts*, R. Pick, ed., Vol. **21B** (1997).
8. “Spectroscopie mécanique locale: vers une analyse thermomécanique à l’échelle submicronique”, F. Oulevey, D. Gourdon, A. Kulik, N. Burnham, E. Dupas and G. Gremaud, “Imagerie des Polymères”, Ch. G’sell éditeur, acts du colloque de Nancy, France, 2-5 février 1998.
9. “Nanoscale Study of Mechanical Properties”, F. Oulevey, D. Gourdon, G. Gremaud, A. J. Kulik, N. A. Burnham, W. Benoit, *Proceedings of Euromat 2000, Tours, France (November 2000)*, p. 917-922, in *Advances in Mechanical Behaviour, Plasticity and Damage*, eds. D. Miannay, P. Costa, D. François, A. Pineau, Elsevier Science, Oxford (2000), ISBN 0-08-042815-0.
10. [1, GS] “The Feasibility of Atomic Force Microscopy as a Cytodetachment Technique to Quantify Osteoblastic Adhesion with Implant Surfaces,” D.J. Gianoli, S.S. Kohles, N.A. Burnham, M.B. Clark, C.A. Brown, and J.N. Kenealy, *Proceedings of the IEEE 27<sup>th</sup> Annual Northeast Bioengineering Conference*, 31 March – 1 April 2001, pp. 5-6.
11. “Quantifying the work of adhesion between an AFM cantilever tip and MEMS test structures after packaging”, E. J. Thoreson, N. A. Burnham, and J. Martin, *Proceedings of the 30<sup>th</sup> International Symposium for Testing and Failure Analysis. (ASM International, Worcester, MA, 2004)*, pp.216-20. ISBN: 0-87170-807-8.
12. “Optimum roughness for minimum adhesion”, D.-L. Liu, J. Martin, and N.A. Burnham, *Proceedings of the STLE/ASME International Joint Tribology Conference*, October 20-22, 2008, Miami, Florida, USA, IJTC2008-71192.

**NANCY A. BURNHAM**  
**Presentations**  
**2011**

**CONFERENCE PRESENTATIONS:**

1. "Auger Line-Shape Analysis of Hydrogenated Amorphous Silicon," N.A. Burnham, A.J. Nelson, A.B. Swartzlander, and L.L. Kazmerski, American Chemical Society's Denver Meeting, June 1986.
2. "EELS Study of Hydrogenated Amorphous Silicon," N.A. Burnham, R.F. Fisher, S.E. Asher, and L.L. Kazmerski, 33rd National Symposium of the American Vacuum Society, Baltimore MD, October 1986.
3. "Core and Valence Levels in Hydrogenated Amorphous Silicon," N.A. Burnham, R.F. Fisher, S.E. Asher, L.L. Kazmerski, G. Lucovsky, and G.N. Parsons, Materials Research Society Fall Meeting, Boston MA, December 1986.
4. "Analysis of CuInSe<sub>2</sub>: Electron and ion beam effects", L.L. Kazmerski, N.A. Burnham, A.B. Swartzlander, A.J. Nelson, S.E. Asher, IEEE Photovoltaic Specialists Conference, 19th, New Orleans, LA, May 4-8, 1987.
5. "Force Microscopy: Instrumentation, Technique and Application," N.A. Burnham and R.J. Colton, Scientific Computing and Automation Conference, Philadelphia PA, October 1988.
6. "Scanning Tunneling and Force Microscopy, Instrumentation and Technique", J.H. Wandass, N.A. Burnham, R.J. Colton, American Chemical Society meeting, 1988.
7. "Measuring Interatomic Forces with an Atomic Force Microscope," N.A. Burnham and R.J. Colton, 36th National American Vacuum Society Symposium, Boston MA, October 26, 1989.
8. "Understanding Force Curves", N.A. Burnham and R.J. Colton, STM '90/Nano I, Baltimore MD, July 25, 1990.
9. "Nanoindentation, Surface Forces and Adhesion Studied with Force Microscopy", N.A. Burnham and R.J. Colton, 37th National American Vacuum Society Symposium, Toronto, Canada, October 9, 1990.
10. "Measurement of Atomic Forces," N.A. Burnham, R.J. Colton, I.L. Singer and H.M. Pollock, International Conference on the Frontiers of Tribology, Stratford-upon-Avon UK, April 15, 1991.
11. "Probing the Surface Forces of Materials using Atomic Force Microscopy", R.J. Colton, N.A. Burnham, B.I. Gans, American Chemical Society, 1991.
12. "Work-Function Anisotropies as an Origin of Long-Range Surface Forces," N.A. Burnham, R.J. Colton and H.M. Pollock, Deutsche Physikalische Gesellschaft Spring Meeting, Regensburg, Germany, March 16, 1992.
13. "The Role of Patch Charge Forces in Force Microscopy," N.A. Burnham and U. Hartmann, Twelfth International Vacuum Congress, The Hague, Netherlands, October 13, 1992.
14. **INVITED:** "A Continuum Model for Force Microscopy Force Curve Data," N.A. Burnham, NATO Workshop on Computations at the Nanoscale, Aspet, France, October 15, 1992.
15. "The convolution of the tip-sample contact stiffness and the cantilever stiffness in scanning force and frictions microscopy", N.A. Burnham, American Chemical Society meeting, 1993.
16. "Patch Charge Forces: An Intrinsic Mechanism of Adhesion," R.J. Colton, N.A. Burnham, U. Hartmann, M. Pabst and J. Schelten, APS Spring Meeting, Seattle WA, March 24, 1993.
17. "Interpretation of Force Curves in Force Microscopy", N.A. Burnham, R.J. Colton and H.M. Pollock, STM'93 Conference, Beijing, China, August 9-13, 1993.
18. "Accounting for the Finite Stiffnesses of the Cantilever, Tip and Sample: Consequences for Image Interpretation", N.A. Burnham, STM'93 Conference, Beijing, China, August 9-13, 1993.
19. "Theoretical Analysis of Capillary Phenomena in Scanning Probe Experiments", U. Hartmann and N.A. Burnham, STM'93 Conference, Beijing, China, August 9-13, 1993.
20. "Scanning Near-field Acoustic Microscopy", N.A. Burnham, A.J. Kulik, G. Gremaud, C. Wüthrich and G.A.D. Briggs, Park Scientific Instruments User's Meeting, Geneva, September 8, 1994.

21. **TUTORIAL:** “Nanoscale Adhesion and Tribology Studied Using Atomic Force Microscopy”, N.A. Burnham, Institut d'Expertise et de Prospective de l'Ecole Normale Supérieure, Paris, October 6, 1994.
22. “Scanning Near-field Acoustic Microscopy”, N.A. Burnham, A.J. Kulik and G. Gremaud, American Vacuum Society Meeting, Denver, October 25, 1994.
23. “Study of Mechanical Properties at the Nanoscale Using a High Frequency Atomic Force Microscope”, F. Oulevey, P.-J. Gallo, N.A. Burnham, A.J. Kulik, G. Gremaud, W. Benoit, Schweizerische Physikalische Gesellschaft Frühjahrstagung, Bern, March 23, 1995.
24. a) “Scanning Local-Acceleration Microscopy: Motivations, Theory and Instrumentation”, N.A. Burnham, A.J. Kulik, P.-J. Gallo, F. Oulevey, S. Stipp and G. Gremaud, Park Scientific Instruments Users Meeting, June 22, 1995;
25. b) “Scanning Local-Acceleration Microscopy: Applications and Future”, N.A. Burnham, A.J. Kulik, P.-J. Gallo, F. Oulevey, S. Stipp and G. Gremaud, Park Scientific Instruments Users Meeting, June 22, 1995, Geneva.
26. **INVITED:** “Scanning Near-field Acoustic Microscopy”, N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo, and F. Oulevey, Congrès Trinoculaire de Microscopies Electroniques, Lausanne, Suisse, 29 juin 1995.
27. “Scanning Local-Acceleration Microscopy Investigations of Ultrafiltration Membranes”, P.-J. Gallo, A.J. Kulik, N.A. Burnham and F. Oulevey, Physique en herbe 95, Nice, July 7, 1995.
28. **INVITED:** “Scanning Local-Acceleration Microscopy”, N.A. Burnham, A.J. Kulik, P.-J. Gallo, F. Oulevey and G. Gremaud, STM '95, Snowmass CO, USA, July 23-28, 1995.
29. **INVITED:** “Scanning Probe Microscopy for Materials’ Properties Measurements”, N.A. Burnham, A.J. Kulik, P.-J. Gallo, F. Oulevey and G. Gremaud, Nanotechnology Workshop, U. Montpellier, France, Sept. 19, 1995.
30. “Nanomechanical Properties Measurements using Scanning Local-Acceleration Microscopy”, N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, Nanotribology SAOG/GSSI Meeting, Fribourg, Suisse, January 25, 1996.
31. **INVITED:** a) “A Beginner’s Guide to Materials Properties Measurements Using SPM”, and
32. **INVITED:** b) “Scanning Local-Acceleration Microscopy: Material Properties Measurements Using High-Frequency Atomic Force Microscopy”, N.A. Burnham, A.J. Kulik, P.-J. Gallo, F. Oulevey and G. Gremaud, NATO-ASI on Micro/Nanotribology and its Applications, Lisbon, June 16-28, 1996.
33. “Tip-Surface Interactions”, A.J. Kulik, N.A. Burnham, G. Gremaud, P.-J. Gallo and F. Oulevey, Workshop on Tip-Surface Interactions, Cambridge UK, April 19th, 1996.
34. “Mechanical Properties Studied at the Nanoscale using Scanning Local-Acceleration Microscopy”, F. Oulevey, N.A. Burnham, A.J. Kulik, P.-J. Gallo, G. Gremaud and W. Benoit, 11th International Conference on Internal Friction and Ultrasonic Attenuation in Solids, Poitiers, France, July 7-11, 1996.
35. “Ultrasound and AFM: An Interesting Marriage”, A. Kulik, N. Burnham, G. Gremaud, F. Oulevey, D. Gourdon and E. Dupas, Park Scientific Instruments User’s Meeting, Paris, September 18-19, 1996.
36. **INVITED:** “Nanoscale Imaging of Materials’ Properties”, A.J. Kulik, N.A. Burnham, G. Gremaud, P.-J. Gallo, and F. Oulevey, Ultrasons Haute Frequence et Microscopie Acoustique, Centre Technique des Industries Mecaniques, Senlis, France, October 8, 1996.
37. **INVITED:** “SPM Images: Artifact, Topography or Materials Properties?”, N.A. Burnham, A.J. Kulik, G. Gremaud, F. Oulevey, D. Gourdon and E. Dupas, 2. Workshop: Raster-Sonden-Mikroskopie an Polymeren, Jahreskolloquium des Sonderforschungsbereichs 239, Ulm, Deutschland, November 22-23, 1996.
38. “High-Velocity Friction Force Microscopy on Organic Monolayers Patterned Via Self-Organization”, D. Gourdon, A.J. Kulik, N.A. Burnham, D. Stamou, M. Liley, C. Duschl and H.

- Vogel, Journées Internationales Francophones de Tribologie, Neuchâtel, Switzerland, March 20-21, 1997;
39. "Near-Field Acoustic Microscopy with Nanometer Resolution", A. J. Kulik, N. A. Burnham, F. Oulevey, D. Gourdon, E. Dupas, P.-J. Gallo and G. Gremaud, Q<sup>-1</sup> Meeting, Lausanne, Switzerland, March 19-21, 1997.
  40. **INVITED:** "Materials Properties Measurements Using Modulation Techniques", N.A. Burnham, A.J. Kulik, G. Gremaud, F. Oulevey, D. Gourdon and E. Dupas, Industrial Applications of SPM, Gaithersburg, Maryland, May 6-8, 1997.
  41. "Phase Transitions in Polymers: Towards Dynamic Mechanical Analysis with Submicron Spatial Resolution," F. Oulevey, A. Hammiche, H. M. Pollock, N. A. Burnham, M. Song, D. J. Hourston and M. Reading, Surfaces and Interfaces in Polymers and Composites, Lausanne, Switzerland, June 1-6, 1997.
  42. **INVITED:** "Scanning Local-Acceleration Microscopy", A.J. Kulik and N.A. Burnham, Ultrasonics International 97, Delft, The Netherlands, July 1-4, 1997.
  43. "How does a Tip Tap?" N.A. Burnham, O.P. Behrend, F. Oulevey, G. Gremaud, P.-J. Gallo, D. Gourdon, E. Dupas, A.J. Kulik, H.M. Pollock and G.A.D. Briggs, STM'97, Hamburg, Deutschland, July 20-25, 1997.
  44. "Nonlinear Dynamical Cantilever Response to Acoustic Excitation: Role of Materials Properties," N.A. Burnham, F. Oulevey, A.J.Kulik, G. Gremaud, E. Dupas, D. Gourdon, J. Berg and G.A.D. Briggs, STM'97, Hamburg, Deutschland, July 20-25, 1997.
  45. "High-Velocity Friction Force Microscopy on Organic Monolayers Patterned Via Self-Organization", D. Gourdon, A.J. Kulik, N.A. Burnham, D. Stamou, M. Liley, C.Duschl and H. Vogel, World Tribology Conference, London, September 8-12, 1997.
  46. "All Warp and No Woof: How Langmuir-Blodgett Films Lie", D. Gourdon, A.J. Kulik, N.A. Burnham, D. Stamou, M. Liley, C. Duschl and H. Vogel, Park Scientific Instruments Users Meeting, Padova, Italy, September 11-12, 1997.
  47. "Friction Anisotropies and Highly Ordered Molecules: an AFM Study", D. Gourdon, M. Liley, N.A. Burnham, D. Stamou, C. Duschl, U. Meseth, F. Oulevey, E. Dupas, A.J. Kulik and G. Gremaud, 14th Mtng of the Swiss Society for Optics and Microscopy, Fribourg, Suisse, January 22, 1998.
  48. "Friction Anisotropies and Highly Ordered Molecules: an AFM Study", D. Gourdon, M. Liley, N.A. Burnham, D. Stamou, C. Duschl, U. Meseth, F. Oulevey, E. Dupas, A.J. Kulik and G. Gremaud, Swiss Physical Society Meeting, Bern, February 26-27, 1998.
  49. "Friction Anisotropies and Highly Ordered Molecules: an AFM Study", D. Gourdon, M. Liley, N.A. Burnham, D. Stamou, C. Duschl, U. Meseth, F. Oulevey, E. Dupas, A.J. Kulik and G. Gremaud, Materials Research Society Spring Meeting, San Francisco, April 13-17, 1998;
  50. "Friction Anisotropies and Highly Ordered Molecules: an AFM Study", D. Gourdon, M. Liley, N.A. Burnham, D. Stamou, C. Duschl, U. Meseth, F. Oulevey, E. Dupas, A.J. Kulik and G. Gremaud, SXM3 Conference, Basel, Switzerland, Sept. 13-17, 1998.
  51. "Direct Measurement of the Elastic Modulus of Single Carbon Nanotubes", J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.-M. Bonard, T. Stöckli, N.A. Burnham and L. Forró, 14th Meeting of the Swiss Society for Optics and Microscopy, Fribourg, Suisse, January 22, 1998.
  52. "Direct Measurement of the Elastic Modulus of Single Carbon Nanotubes", J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.-M. Bonard, T. Stöckli, N.A. Burnham and L. Forró, Materials Research Society Spring Meeting, San Francisco, April 13-17, 1998.
  53. "Direct Measurement of the Elastic Modulus of Single Carbon Nanotubes", J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.-M. Bonard, T. Stöckli, N.A. Burnham and L. Forró Park Scientific Instruments Users Meeting, Amsterdam, September 3-4, 1998.
  54. "Direct Measurement of the Elastic Modulus of Single Carbon Nanotubes", J.P. Salvetat, A.J. Kulik, G.A.D. Briggs, J.-M. Bonard, T. Stöckli, N.A. Burnham and L. Forró SXM3, Basel, Switzerland, September 14-17, 1998.

55. "Mechanical Spectroscopy at the Nanometer Scale with a Modified AFM", F. Oulevey, D. Gourdon, E. Dupas, N.A. Burnham, A.J. Kulik, and G. Gremaud, Swiss Physical Society Meeting, Bern, February 26-27, 1998.
56. **TUTORIAL:** "Measuring Mechanical Properties in the Nanometer Regime", N.A. Burnham and S.P. Baker, Materials Research Society Spring Meeting, San Francisco, April 12, 1998.
57. "Intermittent Contact: Tapping or Hammering?" O.P. Behrend, F. Oulevey, D. Gourdon, E. Dupas, A.J. Kulik, G. Gremaud and N.A. Burnham, Materials Research Society Spring Meeting, San Francisco, April 13-17, 1998.
58. "Local Mechanical Spectroscopy of Polymers and Polymer Blends", F.Oulevey, G. Gremaud, E. Dupas, D. Gourdon, N.A. Burnham and A.J. Kulik, Q<sup>-1</sup> Meeting, Lyon, France, June 30-July 1, 1998.
59. **INVITED:** "Treffpunkt: The Point of Contact", F. Oulevey, D. Gourdon, E. Dupas, J.-P. Salvetat, O.P. Behrend, A.J. Kulik, G. Gremaud and N.A. Burnham, Cercle Français des Microscopies à Champ Proche, Strasbourg, 1-3 juillet, 1998.
60. **INVITED:** "Micromechanics and Microtribology of Polymer Films", F. Oulevey, D. Gourdon, E. Dupas, M. Liley, C. Duschl, A.J. Kulik, G. Gremaud and N. A. Burnham, American Chemical Society Meeting, August 23-27, 1998.
61. "Mixing of Two Acoustic Signals with an AFM", E. Dupas, G. Gremaud, N.A. Burnham, A.J. Kulik, H.-J. Froelich and W. Arnold, Park Scientific Instruments Users Meeting, Amsterdam, September 3-4, 1998.
62. "Mixing of Two Acoustic Signals with an AFM", E. Dupas, G. Gremaud, N.A. Burnham, A.J. Kulik, H.-J. Froelich and W. Arnold, SXM3 Conference, Basel, Switzerland, Sept. 13-17, 1998;
63. "Mixing of Two Acoustic Signals with an AFM", E. Dupas, G. Gremaud, N.A. Burnham, A.J. Kulik, H.-J. Froelich and W. Arnold, Ultrasonics International 99, Berlin, March 1999.
64. "Local Mechanical Spectroscopy of Polymers and Polymer Blends", F. Oulevey, G. Gremaud, N.A. Burnham and A.J. Kulik, SXM3 Conference, Basel, Switzerland, Sept. 13-17, 1998.
65. "Intermittent Contact: Tapping or Hammering?" O.P. Behrend, E. Dupas, D. Gourdon, F. Oulevey, A.J. Kulik, G. Gremaud and N.A. Burnham, SXM3 Conference, Basel, Switzerland, Sept. 13-17, 1998.
66. **INVITED:** "Nanoindentation used to Determine the Mechanical Properties of Thin Films or Bulk Materials with High Spatial Resolution", N.A. Burnham and S.P. Baker, Eröffnungskolloquium des Nanolabs, SURFACE, Hückelhoven, Deutschland, December 9, 1998.
67. **INVITED:** "Acoustical Images at the Nanoscale: Why and How?" A.J. Kulik, E. Dupas, F. Oulevey, D. Gourdon, N. Burnham and G. Gremaud, Ultrasonics International 99, Berlin, March 1999.
68. "Amplitude dependence of down-converted acoustic waves due to a nonlinear force interaction", E. Dupas, G. Behme, A. Kulik, N. A. Burnham, E. Chilla, and H.-J. Froehlich, 137<sup>th</sup> Meeting of the Acoustical Society of America, Berlin, March 1999.
69. **INVITED:** i) "Detection of Ultrasound using an Atomic Force Microscope (AFM) - A Step towards Nanometer Resolution, ii) Continuous Wave Ultrasonics - An Old Method with New Applications," A.J. Kulik, N.A. Burnham, G. Gremaud, 28th Winter School on Molecular & Quantum Acoustics, Ustron, Poland, February 22-27, 1999.
70. **INVITED:** "Friction Anisotropies on Langmuir-Blodgett Films," D. Gourdon, M. Liley, N. A. Burnham, D. Stamou, C. Duschl, U. Meseth, F. Oulevey, E. Dupas, A.J. Kulik and G. Gremaud, 18<sup>th</sup> Journée des Matériaux, Lausanne, Switzerland, March 4-5, 1999.
71. "Phase Imaging: Deep or Superficial?" O.P. Behrend, L. Odoni, J.-L. Loubet and N.A. Burnham, STM '99, Seoul, July 18-23, 1999.
72. "Friction Anisotropy and Asymmetry of a Compliant Molecule Induced by a Small Molecular Tilt," D. Gourdon, C. Duschl, M. Liley, A.J. Kulik and N.A. Burnham, STM '99, Seoul, Korea, July 18-23, 1999.

73. “Local Mechanical Spectroscopy: A New Technique to Study Inhomogeneous Materials”, F. Oulevey, G. Gremaud, A.J. Kulik and N.A. Burnham, STM ‘99, Seoul, Korea, July 18-23, 1999.
74. “Ultrasonic AFM: Tapping from the Other Side,” A. Kulik, N. Burnham, F. Oulevey, E. Dupas and G. Gremaud, nc-AFM ‘99, Pontresina, Switzerland, 1-4 September, 1999.
75. **INVITED:** “Nanomechanics of Modern Materials via Atomic Force Microscopy”, N.A. Burnham, Brinell Conference 1999, Stockholm.
76. **INVITED:** “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, Nanotribology Workshop – Critical Assessment and Research Needs, NIST Gaithersburg, March 13-15, 2000.
77. **PLENARY:** “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, Micro2000/UKSPM2000, London, April 13, 2000.
78. **INVITED:** “Nanomechanics of Surfaces with the AFM”, N.A. Burnham, Quantitative Surface Analysis 11, Surrey, GB, July 3-7, 2000.
79. “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, American Vacuum Society Fall Meeting, Boston, Oct.2-6, 2000.
80. **TUTORIAL:** “Measuring Mechanical Properties in the Nanometer Regime”, N.A. Burnham and S.P. Baker, Materials Research Society Fall Meeting, Boston, Nov. 27, 2000.
81. **INVITED:** “Molecular Tribology of Highly Ordered Monolayers”, D. Gourdon, C. Duschl, N.A. Burnham, Materials Research Society Fall Meeting, Boston, Nov. 27-31, 2000.
82. “The Feasibility of Atomic Force Microscopy as a Cytodetachment Technique to Quantify Osteoblastic Adhesion with Implant Surfaces”, D.J. Gianoli, S.S. Kohles, N.A. Burnham, M.B. Clark, C.A. Brown, J.N. Kenealy, 27<sup>th</sup> Annual Northeast Bioengineering Conference, Storrs, CT, March 31-April 1, 2001.
83. **INVITED:** “The Theory of Technique”, N.A. Burnham, Scanning Probe Microscopy of Polymers, Weingarten, Germany, July 21-25, 2001.
84. **PLENARY:** “Nanomechanics of Surfaces with the AFM”, N.A. Burnham, Surface Analysis ‘02, Nashville TN, May 20, 2002.
85. **INVITED:** “Intermittent-Contact Mode Interpretation”, N.A. Burnham, I-PRIME Master Classes, U. Minneapolis, May 30, 2002.
86. **INVITED:** “Dynamic Force Spectroscopy”, N.A. Burnham, Novel Applications of Atomic Force Microscopy, ACS National Meeting, Colloid Division, Boston, August 18-22, 2002.
87. “Thermal Approach to Cantilever Calibration over a 200 kHz Bandwidth”, G.A. Matei, E.J. Thoreson, N.A. Burnham, 50<sup>th</sup> International AVS Symposium, Baltimore MD, 3-7 November 2003.
88. **INVITED:** “Accuracy and Precision in Atomic Force Microscopy”, N.A. Burnham, Nanotechnology Initiative Interagency Grand Challenge Workshop on Instrumentation and Metrology at NIST, Gaithersburg, MD, January 27-29, 2004.
89. **INVITED:** “Atomic Force Microscopy: Applications beyond Conventional EM”, N.A. Burnham, New England Society of Microscopists, Worcester MA, March 8, 2004.
90. “AFM Measurements of Stiction of MEMS Test Structures after Packaging”, E.J. Thoreson, N.A. Burnham, and J. Martin, International Microelectronics and Packaging Symposium, Boxborough MA, May 6, 2004.
91. **INVITED:** "Intimate inaccurate contact with AFM", N.A. Burnham, Gordon Research Conference on Tribology, Roger Williams University, June 24 - July 2, 2004.
92. **PLENARY:** “Role of Atomic Force Microscopy in Conception, Design, and Characterization of High-Performance and Reliable Nanomaterials”, N.A. Burnham, Workshop on Reliability Issues of Nanomaterials, NIST, Boulder CO, August 18, 2004.
93. “Quantifying the Work of Adhesion between an AFM Cantilever Tip and MEMS Test Structures after Packaging”, E.J. Thoreson, N.A. Burnham, and J. Martin, ISFTA, Worcester MA, 17 November 2004.

94. **PANELIST:** “Measuring Time Dependent Mechanical Properties with Point Probes”, N.A. Burnham, T. Page, G. Pharr, M. Van Landingham, and K. Wahl, MRS Fall Meeting, Boston MA, 30 November 2004.
95. “Work of adhesion between AFM cantilever tips and unpatterned silicon die”, E.J. Thoreson, J. Martin, and N.A. Burnham, MRS Fall Meeting, Boston MA, 1 December 2004.
96. “Challenges of using the AFM for an in-fab stiction monitor for MEMS devices”, E.J. Thoreson, J. Martin, and N.A. Burnham, International Microelectronics and Packaging Symposium, Boxborough MA, May 17, 2005.
97. “Quantitative work of adhesion values for use as an in-fab monitor of stiction,” E.J. Thoreson, J. Martin, and N.A. Burnham, 52<sup>nd</sup> International AVS Symposium, Baltimore MD, 31 October 2005.
98. “A few asperities determine the work of adhesion in nanometer contacts,” E.J. Thoreson, J. Martin, and N.A. Burnham, Materials Research Society Fall Meeting, Boston MA, 30 November 2005.
99. **INVITED:** “Nanoscale acoustical imaging – deep or superficial?” A.J. Kulik, G. Gremaud, L. Forro, R. Szoszkiewicz, and N.A. Burnham, 151<sup>st</sup> Meeting of the Acoustical Society of America, Providence RI, 5-9 June 2006.
100. **DISCUSSION LEADER:** N.A. Burnham, Biotribology Session, Gordon Research Conference on Tribology, Colby College, Waterville ME, 18-23 June 2006.
101. “Substrate Rigidity Regulates the Formation and Maintenance of Tissues”, W. Guo, M. Frey, N. Burnham, Y. Wang, International Conference on Nanoscience and Technology 2006, Basel, Switzerland, July 30-August 4, 2006.
102. “A Few Asperities Determine the Work of Adhesion of Nanometer Contacts”, E. Thoreson, J. Martin, N. Burnham, International Conference on Nanoscience and Technology 2006, Basel, Switzerland, July 30-August 4, 2006.
103. “Getting to the root of bacterial hair”, R. Emerson, T. Camesano, and N. Burnham, AVS 53<sup>rd</sup> International Symposium, San Francisco, November 12-17, 2006.
104. “Substrate Rigidity Regulates the Formation and Maintenance of Tissues”, W. Guo, M. Frey, N. Burnham, Y. Wang, AVS 53<sup>rd</sup> International Symposium, San Francisco, November 12-17, 2006.
105. **INVITED:** “More accurate nanomechanical measurements and modeling of adhesion in MEMS, bacterial exopolymers, and tissue-growth substrates,” N.A. Burnham, Surface and Interfacial Nanomechanics at the 2007 Materials Research Society Spring Meeting, San Francisco April 9-13, 2007.
106. **INVITED:** “An Undergraduate Course on Atomic Force Microscopy,” N.A. Burnham, 2007 Society for Experimental Mechanics Annual Conference and Exposition, Springfield MA, 3-6 June 2007.
107. “Optimal roughness for minimum adhesion”, D. Liu, J. Martin, and N.A. Burnham, International Conference on Nano Science and Technology – 07, Stockholm, 2-6 July 2007
108. “Optimal roughness for minimum adhesion”, D. Liu, J. Martin, and N.A. Burnham, AVS 54<sup>th</sup> International Symposium, Seattle, 14-19 October 2007.
109. **INVITED:** “Does continuum mechanics break down in interpreting nanoscale adhesion data?” D. Liu, E.J. Thoreson, N.A. Burnham, Scanning Probe Microscopy in Modern Nanoscience and Nanotechnology ACS North East Regional Meeting, Burlington, Vermont, June 29 to July 2, 2008.
110. “Low-Wear Variable-Slope Method of Lateral Force Calibration”, S. Chakraborty, D. Eggiman<sup>ug</sup>, C. DeGraf<sup>ug</sup>, K. Stevens<sup>ug</sup>, D. Liu, N. A. Burnham, ACS North East Regional Meeting, Burlington, Vermont, June 29 to July 2, 2008.
111. “Low-Wear Variable-Slope Method of Lateral Force Calibration”, S. Chakraborty, D. Eggiman<sup>ug</sup>, C. DeGraf<sup>ug</sup>, K. Stevens<sup>ug</sup>, D. Liu, N. A. Burnham, 55<sup>th</sup> International AVS Symposium, Boston MA, 19-24 October 2008.
112. “Influence of the Roughness Exponent on Adhesion”, D. Liu, J. Martin, N. A. Burnham, ACS North East Regional Meeting, Burlington, Vermont, June 29 to July 2, 2008.
113. “Influence of the Roughness Exponent on Adhesion”, D. Liu, J. Martin, N. A. Burnham International Conference on Nanoscience and Technology, Keystone CO, July 20-25, 2008.

114. **INVITED:** "Perspectives on the last ten years of force measurements – from understanding instrumentation to testing theoretical assumptions" N.A. Burnham, Nanomechanics Symposium 9, Hueckelhoven, Germany, 9-11 September 2008.
115. "Immobilizing Cecropin P1 for detection of pathogenic *E. coli*", J. Strauss, C. Mello, N.A. Burnham, and T. Camesano, AFM in Biomedicine, Monterey CA, 15-18 October 2008.
116. "Self-affine fractal analysis of MEMS surfaces for minimizing adhesion", D.-L. Liu, J. Martin, N.A. Burnham, 55<sup>th</sup> International AVS Symposium, Boston MA, 19-24 October 2008.
117. "Optimum roughness for minimum adhesion", D.-L. Liu, J. Martin, N.A. Burnham, STLE/ASME International Joint Tribology Conference, Miami, October 20-22, 2008.
118. "Optimal surface parameters for minimal adhesion", D.-L. Liu, J. Martin, N.A. Burnham, AVS New England Annual Symposium, Burlington MA, 8 June 2009.
119. **INVITED:** "Role of LPS heterogeneity on adhesion of gram-negative bacteria", I. Ivanov, J. Strauss, C. Cronin, J. Goldberg, E. Kintz, N. Burnham, P. Pinzon-Arango, E. Anderson, C. Mello, T. Camesano, American Chemical Society Meeting, Washington DC, 16-20 August, 2009.
120. "Which fractal parameter contributes most to adhesion?" D.-L. Liu, J. Martin, N.A. Burnham, International Conference on Surface Metrology, Worcester Polytechnic Institute, Worcester MA, 27 October 2009.
121. "Self-affine fractal analysis of MEMS surfaces for minimizing adhesion", D.-L. Liu, J. Martin, N.A. Burnham, 56<sup>th</sup> International AVS Symposium, San Jose CA, 8-14 November 2009.
122. "The effect of friction in cantilever-on-cantilever spring constant calibrations", G.A. Shaw, J.R. Pratt, L. Kumanchik, N.A. Burnham, SEM Annual Conference, Indianapolis, June 7-9, 2010.
123. "The effects of sample stiffness and sliding friction on force curves in atomic force microscopy," J.R. Pratt, G.A. Shaw, L. Kumanchik, N.A. Burnham, Nanobrücken Special Workshop on Nanomechanical Testing, Saarbrücken, February 25-26, 2010.
124. **INVITED:** "Which fractal parameter most determines adhesion?" D.-L. Liu, J. Martin, N.A. Burnham, ACS North East Regional Meeting, Potsdam NY, June 2-5, 2010.
125. "Sample-Independent Lateral Force Calibration", E. Anderson, T. Esformes, S. Chakraborty, D. Eggiman, C. DeGraf, K. Stevens, D. Liu, and N.A. Burnham, ACS North East Regional Meeting, Potsdam NY, June 2-5, 2010.
126. "Quantitative assessment of sample stiffness and sliding friction from force curves in atomic force microscopy", J.R. Pratt, G.A. Shaw, L. Kumanchik, N.A. Burnham, 57<sup>th</sup> International AVS Symposium, Albuquerque NM, 17-23 October 2010.
127. **INVITED:** "Atomic Force Microscopy, the Eye and Hand of Nanotechnology," N.A. Burnham, NanoWorcester Symposium, Worcester MA, 12 February 2011.

#### **SEMINAR PRESENTATIONS:**

1. "Hydrogenated Amorphous Silicon for Beginners," N.A. Burnham,  
a) Condensed Matter Seminar, University of Colorado at Boulder, and  
b) Amorphous Materials Seminar, Colorado School of Mines, February 1987.
2. "Nanostructural Characterization of Hydrogenated Amorphous Silicon by Surface Analysis Techniques," N.A. Burnham, Physics Department, University of Colorado at Boulder, February 1987.
3. "Atomic Force Microscopy," N.A. Burnham, Physics Department, Swarthmore College, Swarthmore PA, November 3, 1988.
4. "Measuring Nanomechanical Properties and Surface Forces of Materials with an Atomic Force Microscope," N.A. Burnham, Chemistry Department, George Washington University, Washington DC, April 7, 1989.
5. "Surface Forces Measured with an Atomic Force Microscope," N.A. Burnham and R.J. Colton, National Institute for Standards and Technology, Gaithersburg MD, May 31, 1989.
6. "Looking at Atoms- the New Scanning Probe Microscopes," N.A. Burnham, Physics Department, Colgate University, Hamilton NY, April 12, 1990.

7. "Looking at Atoms", N.A. Burnham, Rotary Club of Maryland, Silver Spring, MD, September 19, 1990.
8. "Long-Range Forces in Force Microscopy," U. Hartmann and N.A. Burnham, Institute for Thin Film and Ion Technology External Review Board, Jülich, Germany, March 5, 1992.
9. "Two Cantilever-Sample Interactions in Scanning Probe Microscopy," N.A. Burnham, Naval Research Laboratory, Washington DC, December 17, 1992.
10. "Playing with Atoms- the New Scanning Probe Microscopies," N.A. Burnham,  
a) School of Physics, Lancaster University, Lancaster UK, April 23, 1993; and  
b) Physics Department, Utah State University, Logan UT, May 25, 1993.
11. "Fundamental Mechanisms of Deformation and Adhesion Studied by Force Microscopy", N.A. Burnham, Physics Department, Northeastern University, Boston MA, May 27, 1993.
12. "Interpretation of Force Curves in Force Microscopy", N.A. Burnham, Departement de Physique, Ecole Polytechnique Federale de Lausanne, Switzerland, August 2, 1993.
13. "A Comparison of the Atomic Force Microscope with the Surface Force Apparatus", N.A. Burnham, Laboratoire de Tribologie et Dynamique des Systemes, Ecole Central de Lyon, France, Sept. 17, 1993.
14. "Spektroskopische Möglichkeiten mit den Raster-Sonden-Mikroskopen", N.A. Burnham, Institut für Festkörper Forschung Seminar Reihe, Forschungszentrum Jülich, Deutschland, October 1993.
15. "Analysis of Force Microscopy Data: Adhesion and Local Elastic Properties", N.A. Burnham, Institute of Physics Seminar, University of Fribourg, Fribourg, Switzerland, November 8, 1993.
16. "Scanning Near-field Acoustic Microscopy", N.A. Burnham, A.J. Kulik, G. Gremaud, C. Wüthrich and G.A.D. Briggs, Chemistry Department, US Naval Academy, Annapolis, MD, April 26, 1994.
17. "Nanomechanics and Local Surface Forces: Understanding AFM Data", N.A. Burnham, Groupe de Physique Appliqué, Université de Genève, July 11, 1994.
18. "Nanoscale Materials Properties Studied Using Scanning Probe Techniques", N.A. Burnham, National Institute of Standards and Technology, Boulder CO, October 21, 1994.
19. "Développements en Microscopies Acoustique et à Force Atomique pour la Caractérisation Mécanique Localisée des Surfaces et Interfaces", N.A. Burnham, A.J. Kulik, P.-J. Gallo, F. Oulevey and G. Gremaud, U. Fribourg, Switzerland, December 12, 1994.
20. "Nanoscale Materials Properties Studied Using Scanning Probe Techniques", N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, Oberflächentechnik, Eidgenössische Technische Hochschule Zürich, February 23, 1995.
21. "Nanoscale Imaging of Materials' Properties", N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, National Institute of Standards and Technology, Boulder CO, July 21, 1995.
22. "Nanomechanics: The Physics of Intimate Contact", N.A. Burnham, A.J. Kulik, G. Gremaud, P.-J. Gallo and F. Oulevey, Condensed Matter Seminar, Oxford University, October 26, 1995.
23. "Microscopies à champ proche: choix et applications", P.J. Gallo, N. A. Burnham, A. J. Kulik, F. Oulevey, G. Gremaud, Ecole Supérieure de Chimie Physique Electronique, December 8, 1995.
24. "Scanning Probe Microscopy and Materials Science", N.A. Burnham, Department of Materials, Swiss Federal Institute of Technology, Lausanne, Switzerland, January 30, 1996.
25. "Scanning Probe Microscopy and Nanomechanics: The Physics of Intimate Contact", N.A. Burnham,  
a) Physics Department, Colorado State University, Ft. Collins CO, March 7, 1996;  
b) Physics Department, Colorado School of Mines, Golden CO, March 12, 1996;  
c) Département de Physique, Université de Neuchâtel, Neuchâtel, Suisse, April 10, 1996;  
d) Istituto di Biofisica, Consiglio Nazionale delle Ricerche, Pisa, Italy, May 28, 1996;  
e) Department of Physics and Astronomy, Colgate University, Hamilton, NY, 2.18, 1997.
26. "Nanomechanics: Exploiting the Nonlinearity of the Tip-Sample Interaction", N.A. Burnham,  
a) University of Basel, Basel, Switzerland, July 1, 1996;  
b) Fraunhofer-Izfp Saarbrücken, Deutschland, July 17, 1996;  
c) Department of Mechanical Engineering, Stanford University, January 9, 1997;  
d) Department of Physics, U. Massachusetts, Amherst, MA, February 19, 1997;

- e) The Linear Approximation, Dartmouth College, Hanover, NH, February 20, 1997;  
 f) Beyond Linearity, Dartmouth College, Hanover, NH, Feb. 21, 1997.
27. "Nanomechanics: Extracting Materials Properties from SPM Data," N.A. Burnham, A.J. Kulik, G. Gremaud, F. Oulevey, D. Gourdon and E. Dupas, University of Bordeaux, Bordeaux, October 9, 1996.
  28. "SPM Images: Artifact, Topography or Materials Properties?" N.A. Burnham, A.J. Kulik, G. Gremaud, F. Oulevey, D. Gourdon and E. Dupas, Max-Planck-Institut für Metallforschung, Stuttgart, November 21, 1996.
  29. "From Oil Tankers to Atoms: Nonlinear Dynamics and Chaos," N.A. Burnham, Department of Mechanical Engineering, Stanford University, January 10, 1997.
  30. "Treffpunkt: The Point of Contact," N.A. Burnham,
    - a) Thayer School of Engineering, Dartmouth College, Hanover, NH, May 9, 1997;
    - b) Physics Department, Western Washington University, Bellingham, 2.10, 1998;
    - c) Physics Department, Northeastern University, Boston, MA, February 12, 1998;
    - d) Physics Department, Simon Fraser University, Burnaby, BC, March 4, 1998;
    - e) Physics Department, University of Oregon, Eugene, OR, March 9 & 10, 1998;
    - f) Department of Applied Physics, Delft University of Technology, March 24, 1998;
    - g) Sandia National Laboratory, Albuquerque, NM, August 17, 1998;
    - h) Lehigh University, Department of Physics, Bethlehem, PA, November 12, 1998;
    - i) McGill University, Department of Physics, Montreal, CA, November 16, 1998;
    - j) Syracuse University, Department of Physics, Syracuse, NY, November 19, 1998;
    - k) University of Wisconsin at Madison, Interdepartmental Colloquium, January 14, 1999;
    - l) University of New Hampshire, Department of Physics, Durham, NH, March 8, 1999;
    - m) Worcester Polytechnic Institute, Department of Physics, Worcester, MA, March 9, 1999.
  31. "Mechanical Properties of Materials at the Nanoscale: Phase Transitions in Polymer Blends and Metallic Point Contacts," N.A. Burnham, Rohm and Haas Corporation, Philadelphia, November 13, 1998.
  32. "Probing Mechanical Properties at the Nanoscale: Local Dynamic Mechanical Analysis, Dynamic Force Spectroscopy, and Friction Anisotropy," D. Gourdon, O.P. Behrend, F. Oulevey, E. Dupas, M. Liley, C. Duschl, A.J. Kulik, G. Gremaud, and N.A. Burnham,
    - a) University of Freiburg, Deutschland, Materials Research Center, December 11, 1998;
    - b) University of Münster, Deutschland, Interface Physics Group, February 10, 1999;
    - c) University of Twente, Chemical Technology Institute, February 12, 1999.
  33. "Getting More out of your AFM", N.A. Burnham, Royal Institute of Technology, Stockholm, April 23, 1999.
  34. "Small is Beautiful, Small is Different, Small is Elegant", N.A. Burnham,
    - a) Royal Institute of Technology, Stockholm, Sweden, April 23, 1999;
    - b) Karlstad University, Department of Physics, Karlstad, Sweden, April 26, 1999;
    - c) Tokyo Institute of Technology, Tokyo, July 14, 1999;
    - d) Physics Department, Worcester Polytechnic Institute, May 1, 2000;
    - e) Chemistry Department, University of Western Ontario, London ON, May 10, 2000;
    - f) Physics Department, Clark University, Worcester MA, September 14, 2000;
    - g) Physics Department, University of Massachusetts at Lowell, November 8, 2000;
    - h) WPI's International CEO Roundtable on the *Impact of Evolving Technologies on the Future of Business*, Barcelona, April 20, 2001.
    - i) WPI's International CEO Roundtable on the *Impact of Evolving Technologies on the Future of Business*, Worcester, March 18, 2002;
    - j) Hysitron Inc., Minneapolis, May 30, 2002.
    - k) Colgate University, March 29, 2003.
  35. "Thermo-mechanical Properties at the Nanoscale: Monolayers, Nanotubes, and Phase Transitions," N.A. Burnham, Tsukuba, Japan, July 12, 1999.
  36. "Interpreting Stiffness and Damping Data from Polymer Composites", N.A. Burnham,

- a) Cornell University Department of Materials, Ithaca, NY, February 17, 2000;  
 b) Naval Research Laboratory Surface Chemistry Branch, Washington DC, March 9, 2000.
37. "How does a Tip Tap?" N.A. Burnham,  
 a) MIT Nanomechanics Class, Cambridge MA, April 21, 2000;  
 b) University of Western Ontario SPM Class, London ON, May 8, 2000.
38. "Mechanical Properties of Carbon Nanotubes", N.P. Thompson<sup>ug</sup> and N.A. Burnham, Project Presentation Day, WPI, April 2002.
39. "Nanomechanics of Modern Materials via Atomic Force Microscopy", N.A. Burnham, Mechanical Engineering Department, WPI, April 26, 2001.
40. "Ties that Bind", WPI's Presidential Roundtable, April 26, 2002.
41. **Inst. of Physics of Ireland Lecturer**, "Pitfalls in the Interpretation of AFM Images", N.A. Burnham  
 a) University of Limerick, October 14, 2002;  
 b) University of Ulster Jordanstown, October 16, 2002;  
 c) Trinity College Dublin, October 18, 2002.
42. "The Promise and Peril of Nanotechnology", N.A. Burnham, WPI's NCSSTMST Student Conference, October 24, 2002.
43. "Study of Microsensor Substrates", E. Cagin<sup>ug</sup> and N.A. Burnham, Analog Devices Incorporated, Cambridge MA, February 5, 2003.
44. "Nanotube Tutorial", N.A. Burnham, Second Friday Seminar, WPI, March 14, 2003.
45. "Searching for Molecular Motion", J.N. Waddell<sup>ug</sup>, E.J. Thoreson and N.A. Burnham, Project Presentation Day, WPI, 15 April 2003.
46. "Adhesion between ADI Test Structures and AFM Tips", E.J. Thoreson and N.A. Burnham, Analog Devices Inc., Cambridge MA, June 3, 2003.
47. "Measuring the Mechanical Properties of Nanostructures", N.A. Burnham,  
 a) Dept. of Mechanical Engineering, Yale University, April 2, 2003;  
 b) Shipley Corporation, Marlborough MA, August 8, 2003;  
 c) Materials Science Program, University of New Hampshire, Durham NH, October 8, 2003.
48. "Nanotechnology – The Next Small Thing", N.A. Burnham and W.G. McGimpsey, Museum of Science, Boston, 21 January 2003.
49. "Shear Stiffness of Carbon Nanotubes", A. Kaczowka<sup>ug</sup> and N.A. Burnham, Project Presentation Day, WPI, 20 April 2004.
50. "Puzzles of Atomic Contact", N.A. Burnham, Department of Chemical Engineering, Princeton University, 10 May 2004.
51. "AFM Measurements of Stiction on MEMS Test Structures after Packaging", E.J. Thoreson, N.A. Burnham and J. Martin, Analog Devices Incorporated, Cambridge MA, 2 June 2004.
52. "Carbon Nanotubes as Mechanical Structures and Other Applications of Atomic-Force Microscopy to Materials Science", N.A. Burnham, Materials Science Seminar, WPI, September 30, 2004.
53. "Calibrated AFM measurements to detect changes in die surfaces after packaging", E.J. Thoreson, J. Martin, N.A. Burnham, Graduate Student Colloquium, WPI, 6 October 2004.
54. "Calibrating an AFM to measure the works of adhesion between an AFM tip and MEMS test structures after packaging," E.J. Thoreson, J. Martin, and N.A. Burnham, National Institute of Standards and Technology, 3 November 2004.
55. "Puzzles of Atomic Contact", N.A. Burnham,  
 a) Department of Materials Science, University of Connecticut, 2 March 2005;  
 b) Department of Mechanical Engineering, University of Vermont, 27 January 2006;  
 c) Department of Mechanical Engineering, Northeastern University, 24 March 2006.
56. "An Effective Stiffness Approximation for Atomic-Force-Microscope Cantilevers", M. McCowan<sup>ug</sup> and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 19 April 2005.

57. "Characterizing Viscoelastic Properties of Polyacrylamide Gels," Z. Gautreau<sup>ug</sup>, J. Griffin<sup>ug</sup>, T. Peterson<sup>ug</sup>, P.Thongpradit<sup>ug</sup>, N.A. Burnham, and K. Billiar, Project Presentation Day, Physics Department, WPI, 21 April 2006.
58. "Exploring liquid crystal properties with AFM" A. Bothmer<sup>ug</sup>, K. Glynn<sup>ug</sup>, and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 21 April 2006.
59. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 488X, Introduction to Nanomaterials and Nanotechnology, WPI, 26 January 2007.
60. "Optimal roughness for minimum stiction", D. Liu, J. Martin, and N.A. Burnham, Micromachined Products Division, Analog Device Incorporated, 14 February 2007.
61. "Lateral force calibration for probe microscopy", C. DeGraf<sup>ug</sup>, K. Stevens<sup>ug</sup>, D. Liu, and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 17 April 2007.
62. "Probing the dynamics of scarpharca dimeric hemoglobin with normal mode analysis", D. Pesce<sup>ug</sup>, J. Sanders<sup>ug</sup>, W. Royer, and N.A. Burnham, Project Presentation Day, Physics Department, WPI, 17 April 2007.
63. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 31 January 2008.
64. "The physics of intimate contact", N.A. Burnham, Worcester State College, 13 February 2008, Sponsored by the American Physical Society Committee on the Status of Women in Physics.
65. "Mean-Value Method of Lateral Force Microscopy," D. Eggiman<sup>ug</sup>, N.A. Burnham, Project Presentation Day, Worcester Polytechnic Institute, 15 April 2008.
66. "Quantum conductance," C. Bruner<sup>ug</sup>, R. Garcia, N.A. Burnham, Project Presentation Day, Worcester Polytechnic Institute, 15 April 2008.
67. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 20 February 2009.
68. "A personal view of rural development in Vietnam and Cambodia", N.A. Burnham and F.L. Hutson, Physics Department Colloquium, 22 April 2009.
69. "Polymer brush force modeling and experiment", E. Anderson, P. Pinzon, T. Camesano, and N.A. Burnham, Project Presentation Day, WPI, 23 April 2009.
70. "Nanoscience and technology at WPI", N.A. Burnham, for BME 1001, Introduction to Biomedical Engineering, WPI, 5 May 2009.
71. "How does topography influence stiction?" E.J. Thoreson, D.-L. Liu, J. Martin, and N.A. Burnham, Analog Devices Incorporated, Cambridge MA, 17 August 2009.
72. "Which fractal parameter contributes most to adhesion?" D.-L. Liu, J. Martin, and N.A. Burnham, Analog Devices Incorporated, Cambridge MA, 17 August 2009.
73. "Kelvin probe force microscopy," N.A. Burnham, Analog Devices Incorporated, Cambridge MA, 17 August 2009.
74. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 8 February 2010.
75. "Scanning Probe Microscopy and Nanomechanics – the Physics of Intimate Contact," N.A. Burnham, Colby College Physics Department, Waterville ME, 15 February 2010.
76. "Nanoscience and technology at WPI", N.A. Burnham, for BME 1001, Introduction to Biomedical Engineering, WPI, 20 April 2010.
77. "Sample independent friction force calibration," T. Esformes, S. Chakraborty, D. Eggiman, C. DeGraf, K. Stevens, D. Liu, and N.A. Burnham, Project Presentation Day, WPI, 22 April 2010.
78. "Atomic Force Microscopy and its application to membrane biophysics," N.A. Burnham, Experimental Biophysics, WPI, 9 December 2010.

79. "Sample independent lateral force calibration," E. Anderson, T. Esformes, S. Chakraborty, D. Eggiman, C. DeGraf, K. Stevens, D. Liu, and N.A. Burnham, Physics Department Colloquium, WPI, 13 December 2010.
80. "Carbon nanotubes as mechanical structures: an example application of atomic-force microscopy to materials science", N.A. Burnham, for ME 4875, Introduction to Nanomaterials and Nanotechnology, WPI, 27 January 2011.

#### POSTERS:

1. "Cantilever-Sample Contact Area in Force Microscopy," N.A. Burnham, I.L. Singer and R.J. Colton, 35th National American Vacuum Society Symposium, Atlanta, GA, October 3, 1988.
2. "Aspects of Force Microscopy," N.A. Burnham, A. Birkner, C. Heiden, R.J. Colton and H.M. Pollock, NATO Advanced Study Institute on the Fundamentals of Friction, Braunlage/Harz, Germany, July, 1991.
3. "Compact Design of a UHV Force Microscope Using Fiber Optic Detection," N.A. Burnham, A. Birkner and C. Heiden, STM '91, Interlaken, Switzerland, August, 1991.
4. "Interpretation Issues in Materials' Properties Measurements at Ultrasonic Frequencies", A.J. Kulik, N.A. Burnham, G. Gremaud, P.-J. Gallo and F. Oulevey, STM '95, Snowmass CO, July 23-28, 1995.
5. "Study of Mechanical Properties at the Nanoscale Using Scanning Local-Acceleration Microscopy", F. Oulevey, P.J. Gallo, N.A. Burnham, A.J. Kulik and G. Gremaud, European Conference on Applications of Surface and Interface Analysis, October 1995, Montreux, Switzerland.
6. "Mechanical Properties Studied at the Nanoscale Using Scanning Local-Acceleration Microscopy", E. Dupas, F. Oulevey, D. Gourdon, P.-J. Gallo, N.A. Burnham and G. Gremaud,
  - a) Euromat Junior '96, August 26-30, 1996, Lausanne, Switzerland; and
  - b) Nanosciences Workshop, Hasliberg, Switzerland, October 7-11, 1996.
7. "High-Velocity Friction Force Microscopy on Organic Monolayers Patterned Via Self-Organization", D. Gourdon, A.J. Kulik, N.A. Burnham, D. Stamou, M. Liley, C. Duschl and H. Vogel, Nanosciences Workshop, Hasliberg, Switzerland, October 7-11, 1996.
8. "Mixing of Ultrasonic Signals with an AFM", E. Dupas, A. Kulik, D. Gourdon, F. Oulevey, N.A. Burnham, G. Gremaud and W. Arnold, STM'97, Hamburg, Deutschland, July 20-25, 1997.
9. "Towards Local Phase-Transition Studies Using Variable Temperature Scanning Local-Acceleration Microscopy," F. Oulevey, A.J. Kulik, N.A. Burnham, E. Dupas, D. Gourdon and G. Gremaud, STM'97, Hamburg, July 20-25, 1997.
10. "How does a Tip Slip? The Relation between Friction and Molecular Tilt in Thiolipid LB Films," D. Gourdon, F. Oulevey, A.J. Kulik, N.A. Burnham, D. Stamou, M. Liley, C. Duschl and H. Vogel,
  - a) STM'97, Hamburg, Deutschland, July 20-25, 1997;
  - b) Imagerie des Polymères, 3-5 février 1998, Nancy, France.
11. "Towards Local Mechanical Spectroscopy: Elasticity and Viscoelasticity of Polymer Blends," F. Oulevey, D. Gourdon, A.J. Kulik, N.A. Burnham, E. Dupas and G. Gremaud,
  - a) 14th Meeting of the Swiss Society for Optics and Microscopy, Fribourg, January 22, 1998;
  - b) Imagerie des Polymères, Nancy, France, 3-5 février 1998;
  - c) Materials Research Society Spring Meeting, San Francisco, April 13-17, 1998.
12. "Amplitude Dependence of Down-Converted Acoustic Waves due to a Nonlinear Force Interaction," E. Dupas, G. Behme, A. Kulik, N. Burnham, E. Chilla and H.-J. Fröhlich, STM '99, Seoul, Korea, July 18-23, 1999.
13. "Calibration Method for Atomic-Force Microscopy Cantilevers," G.A. Matei, E.J. Thoreson, N.A. Burnham, X. Chen, C.S. Hodges, AVS 49<sup>th</sup> International Symposium, Denver CO, 4-8 November 2002.
14. "Stiction Measurements Made with an Atomic Force Microscope on Test Structures with Various Die-Attach Materials", E.J. Thoreson, J. Martin, N.A. Burnham

- a) 50<sup>th</sup> AVS International Symposium, Baltimore MD, 3-7 November 2003;  
 b) MRS Fall Meeting, Boston MA, 1-5 December 2003.
15. "Quantifying the Work of Adhesion between an AFM Cantilever Tip and MEMS Test Structures after Packaging", E.J. Thoreson, N.A. Burnham, and J. Martin, ISFTA, Worcester MA, 17 November 2004.
  16. "SI-traceable verification of a thermal cantilever calibration method for AFMs", G.A. Matei, E.J. Thoreson, J.R. Pratt, D.B. Newell, and N.A. Burnham, NIST internal review, 23 November 2004.
  17. "Metrology for AFM stiction measurements", C.A. Rehm, E.J. Thoreson, and N.A. Burnham, International Microelectronics and Packaging Symposium, Boxborough MA, May 17, 2005.
  18. "An undergraduate course on Atomic Force Microscopy," N.A. Burnham, Materials Research Society Fall Meeting, 29 November 2005.
  19. "What's a few small bumps between friends?" E.J. Thoreson, J. Martin, and N.A. Burnham, Gordon Research Conference on Tribology, Colby College, Waterville ME, July 18-23, 2006.
  20. "Getting to the root of bacterial hair", R. Emerson, T. Camesano, and N. Burnham, International Conference on Nanoscience and Technology 2006, Basel, Switzerland, July 30-August 4, 2006.
  21. "UV-cleavable polyacrylamide substrates for spatio-temporal mechanotransduction studies," M.T. Frey, N.A. Burnham, Y. Wang, Biomedical Engineering Society Meeting, Chicago, October 11-14, 2006.
  22. "Optimal roughness for minimum stiction", D. Liu, J. Martin, and N.A. Burnham, Graduate Research Achievement Day, Worcester Polytechnic Institute, 28 March 2007.
  23. "Probing the dynamics of scarpharca dimeric hemoglobin with normal mode analysis", D. Pesce<sup>ug</sup>, J. Sanders<sup>ug</sup>, W. Royer, and N.A. Burnham, Project Presentation Day, Department of Biology and Biotechnology, WPI, 17 April 2007.
  24. "Optimal roughness for minimum stiction", D. Liu, J. Martin, and N.A. Burnham, Seeing at the Nanoscale V, Santa Barbara CA, 24-27 June 2007.
  25. "Magnetite synthesis on micro-composites made of bentonite and xanthan", D.D. Bilanovic, T.J. Kroeger, and N.A. Burnham, MC8: Advancing Materials by Chemical Design, London, 2-7 July, 2007.
  26. "Optimal roughness for minimal adhesion", D. Liu, J. Martin, and N.A. Burnham,
    - a) MRS Fall Meeting, Boston, 26-30 November 2007.
    - b) 2008 NSTI Nanotechnology Conference and Trade Show, June 1-5, 2008, Boston
  27. "Effect of the roughness exponent on adhesion", D. Liu, J. Martin, and N.A. Burnham, Graduate Research Achievement Day, Worcester Polytechnic Institute, 19 March 2008.
  28. "Low-wear variable-slope method of lateral force calibration," S. Chakraborty, D. Eggiman<sup>ug</sup>, C. DeGraf<sup>ug</sup>, K. Stevens<sup>ug</sup>, D. Liu, and N.A. Burnham,
    - a) International Conference on Nanoscience and Technology, Keystone CO, 20-25 July 2008;
    - b) National Nano-Engineering Conference, Boston MA, 12 November 2008.
  29. "Magnetite Coating of Colloidal Clay-Xanthan Aggregates," D.D. Bilanovic, T.J. Kroeger, R. Armon, C.A. Rehm and N.A. Burnham, Gordon Research Conference - Green Chemistry 2008, August 3-8, 2008, Bates College, Lewiston, ME.
  30. "Getting to the root of bacterial hairs," E. Anderson, P. Pinzon-Arango, I. Ivanov, T.A. Camesano, and N.A. Burnham,
    - a) Graduate Research Appreciation Day, WPI, Worcester MA, 31 March 2010;
    - b) Sigma Xi Northeast Regional Conference, Quinnipiac University, New Haven, 17 April 2010.
  31. "Surface-independent friction force calibration," T. Esformes and N.A. Burnham, Sigma Xi Northeast Regional Conference, Quinnipiac University, New Haven CT, 17 April 2010.
  32. "Environmental Guidelines for Nanotechnology," Z. Chen, A. Lamb, C. Liu, L. Luo, N.A. Burnham, J. Shatkin, Sustainability Poster Competition, Worcester Polytechnic Institute, 21 April, 2010.

## NANCY A. BURNHAM

### Projects

2011

#### STUDENT PROJECTS:

1. M. Lennartz, "Optischer und mechanischer Aufbau eines Rasterkraftmikroskops" Diplomarbeit, Fachhochschule Aachen, Abteilung Jülich, 1992-93.
2. F. Oulevey, "Détermination des propriétés mécaniques de surface des matériaux à l'échelle microscopique grâce à la propagation d'ondes ultrasonores pendant une mesure AFM," diplôme, EPFL, 1994-95.
3. F. Oulevey, "Cartographie et spectrométrie des propriétés mécanique a l'échelle nanométrique par microscopie en champ proche," thèse, EPFL, 1995-99.
4. D. Gourdon, "Molecular Tribology of Highly Ordered Monolayers," PhD thesis, EPFL, 1996-99.
5. E.J. Thoreson , "Apparatus to deliver light to the tip-sample interface of an atomic force microscope", M.S. Physics, WPI, August 2002.
6. N.P. Thompson, "Mechanical Properties of Carbon Nanotubes", WPI senior research project, 2001-02.
7. E. Cagin, "Durability of Microsensor Surfaces", WPI independent study project, 2002-03.
8. J.N. Waddell, "Molecular Photomechanics", WPI senior research project, 2002-03.
9. A.B. Kaczowka, "Shear Stiffness of Carbon Nanotubes", WPI senior research project, 2003-04.
10. M.S. McCowan, "An Effective Stiffness Approximation for AFM Cantilevers", WPI senior research project, 2004-05.
11. T. Allwood, K. Psiakis, T. Regan, "Will 'Prey' Consume Nanotechnology?" WPI junior research project, 2004-05, Co-advisor I. Bar-On.
12. E.J. Thoreson, "From the nanoscale to the macroscale, using the atomic force microscope to quantify the role of few-asperity contacts in adhesion," Ph.D. in Physics, Fall 2005.
13. A.V. Sklyar, J.W. Smith, C.C. Stedman II, "Social Acceptance of Technologies" WPI junior research project, 2005-06, Co-advisor J. Liang.
14. Z. Gautreau, J. Griffin, T. Peterson, P. Thongpradit, "Characterizing Viscoelastic Properties of Polyacrylamide Gels," WPI senior research project, 2005-06. Co-advisor to K. Billiar.
15. A. Bothmer, K. Glynn, "Exploring liquid crystal properties with AFM", WPI senior research project 2005-06. Co-advisor G. Iannacchione.
16. D. Liu, "Properties of microsensor surfaces", postdoctoral research, 2006-09
17. David Pesce, PH '07, Jeffrey Sanders, PH '07, "Physics of molecular motors," WPI senior research project, 2006-07.
18. Colin DeGraf, PH '07, Keeley Stevens, PH '07, "Lateral force calibration," WPI senior research project, 2006-07.
19. Nathalia Arenas, CBC '08, Katelyn Ryan, BBT '08, Ergys Subashi, PH '08, "Social acceptance of nanomedicine," WPI junior research project 2006-07.
20. Christopher Bruner, PH '08, "Quantum Conductance," WPI senior research project, 2007-08.
21. Derek Eggiman, PH '08, "Improved lateral force calibration," WPI senior research project, 2007-08.
22. David Beavers AE '09, Calvin Goodrich ECE '09, Brad Kaufman BCB '09, "Nanoscience and society," WPI junior research project, 2007-08.
23. David Aaron Costello, Yuval Harel, Justin LeBeau, Robert Warren, "Nanoscience and society", 2007-08
24. Evan Anderson, PH '09, "Physics of biopolymers", 2008-11.
25. Zhen Chen, Alexander Lamb, Chang Liu, Lan Luo, "Environmental guidelines for nanotechnology", 2009-10.
26. Taylor Esformes, "Lateral force calibration on arbitrary surfaces", 2009-10.

27. Nathan T Nesbitt, PH '11, Daniel Nuzzo-Mueller, PH '11, "Charge separation in thin films", 2010-11.
28. Gregory D Anderson, CM '12, Michael A Jenkins, ME '12, Casey J Rivera, CM '12, Yow-Chyuan Yeh, BE '12, "EcoTarium Energy Project", B10-C11.
29. Mariela L Castillo, ME '12, Tanawit Permsuk, CE '12, Eduardo LE Pizzini, ECE '12, Daniel B Thomas, ECE '12, Daniel C Valerio, BIO '12, "Green Renovations for the Worcester Youth Center", B10-C11.
30. John P Flynn, CE '12, John K Pearsall, RBE '12, Michael A Pettiglio, BIO '12, Yiming Wu, ECE '11, "Worcester Public Library Programming", B10-C11.
31. Zhichao Liao, CE '12, Eric D Petrin, MA '12, James M Post, MIS '12, "Determining the Economic Value of Trees", B10-C11.

**EXTRADEPARTMENTAL THESES, DISSERTATIONS, AND HABILATIONS REFERRED:**

1. A.Menck, "Defects and growth processes at ionic and oxide crystal surfaces studied by atomic force microscopy," external PhD thesis committee member, EPFL, October 1998.
2. H. Kim, "Magneto-optic properties of Ce-substituted yttrium iron garnet films by pulsed laser deposition", licentiate exam committee member, KTH Stockholm, 9 November 1999.
3. I.M. Krausz, "Synthesis of Nanostructured Inorganic Materials for Enhanced Heterogeneous Catalysis", PhD proposal committee member, WPI, 25 August 2000.
4. I.M. Krausz, "Synthesis of Nanostructured Inorganic Materials for Enhanced Heterogeneous Catalysis", PhD defense committee member, WPI, 21 March 2002.
5. L. Romana, Université des Antilles et de la Guyane, habilitation committee member, 27 September 2002.
6. S. Cuenot, "Reduced-Size Effect on the Elastic Modulus of Nanomaterials: Measurement with AFM-based methods", Université catholique de Louvain, PhD thesis committee member, 25 June 2003.
7. R.J. Emerson, "A Nanoscale Investigation of Pathogenic Microbial Adhesion in Biomaterial Systems", PhD Proposal committee member, Chemical Engineering Department, WPI, 16 December 2003.
8. D. Bennett, "Neuronal Magnetism Detection by Magnetic Resonance Imaging as an Indicator of Motor Recovery after Stroke in Adults", Biomedical Engineering Department, WPI, Ph.D. Qualifying Examinations, 30 July 2004 and 31 August 2004.
9. M. Reinstädler, "Elastische und tribologische Oberflächencharakterisierung auf der Nanoskala mittels Torsions- und Lateralmoden von Sensorbalken der Rasterkraftmikroskopie", Universität des Saarlandes, Ph.D. thesis external reviewer, January 2005.
10. J. Balestrini, "Pulmonary myofibroblast activation: possible interaction between cyclic stretch, TGF- $\beta$ , and EN-1", Biomedical Engineering Department, WPI, Ph.D. Qualifying Examination, 25 October and 9 December 2005.
11. P. Bilas, "Approche quantitative des phénomènes de frottement à l'échelle atomique et méso échelle par microscopie à force de frottement," Université des Antilles et de la Guyane, PhD thesis committee member, 23 November 2005.
12. R.J. Emerson, "A Nanoscale Investigation of Pathogenic Microbial Adhesion in Biomaterial Systems", PhD defense committee member, 5 April 2006.
13. A.R. Klempner, "Development of a modular interferometric microscopy system for characterization of MEMS", Mechanical Engineering Department, WPI, M.S. thesis defense, 19 December 2006
14. P.A. Pinzon-Arango, "Impact of sporulation environment on the germination, virulence, and killing of *Bacillus anthracis* spores," PhD Qualifying Examination committee member, 29 November 2010.