Jason D. Fowlkes
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EDUCATION
The University of Tennessee Knoxville, TN
Doctor of Philosophy in Materials Science and Engineering
December 2002 GPA: 3.88/4.00
Dissertation: *Self Assembly of Nanostructures in Silicon*

The University of Tennessee Knoxville, TN
Master of Science in Materials Science and Engineering
August 1999 GPA: 4.00/4.00
Thesis: *Growth of Silicon Microcone/Microcolumn Arrays by Nanosecond Pulsed Laser Irradiation*

The University of Tennessee Knoxville, TN
Bachelor of Science in Materials Science and Engineering
May 1997 GPA: 3.75/4.00
Senior Projects: *Room Temperature Fatigue Study of Cold-Worked 304 Stainless Steel* and *Tool Steel Failure in Heat Treatment*

The University of Alabama Tuscaloosa, AL
Coursework in Metallurgical Engineering
Fall 1992 – Spring 1994 GPA: 3.88/4.00

HONORS & AWARDS

Faculty Award for Excellence in Teaching 2016, Materials Science and Engineering Department, The University of Tennessee, Knoxville

Center for Nanophase Materials Sciences 2016 Distinguished Scientific Paper

Tau Beta Pi National Honor Society, Alpha Lambda Delta National Honor Society, Phi Eta Sigma National Honor Society, ASM Oak Ridge Chapter Scholarship, Outstanding Graduate Student Materials Science and Engineering 2002, Sigma Xi Oral Presentation Competition Winner 2000, Outstanding Senior Materials Science and Engineering (UT) 1997, Big Brothers & Big Sisters of America (3 years), Summa Cum Laude (UT) fall 1994, 96, and 97, President's List (UA) spring 1994

RESEARCH

December 2007 – Present
Staff Scientist
Nanofabrication Research Laboratory Research Staff Member, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory (subcontract assignment)

- Nanofabrication techniques including electron beam lithography, focused ion beam etching/deposition, electron beam induced etching/deposition, sub–micron soft lithography and standard microfabrication procedures.
- Additional skills include experience with the electron beam lithography technique to define, pattern, and integrate nanoscale features, nanoscale thin film editing using electron and ion beams to affect thin film catalytic properties, and a maskless lithography technique using focused electron beam deposition of the multiple material layers to define ultrafine features (< 20 nm)
- Microfabrication skills integrating multiple processes including physical vapor deposition, chemical vapor deposition, photolithography, and reactive ion etching. Experience with soft lithography template preparation for patterning sub–micron molecular layers and monolayers.
- Developed simulation packages to help predict and understand multiple nanofabrication techniques including electron beam lithography, electron beam induced deposition, combinatorial sputtering, and diffusive transport in micro/nanofluidic structures.
- Extensive experience interacting with users including on–site training, providing design aid to best reach a user's final device, preparing specific user work plans per visit, and troubleshooting hardware and software problems as they arise. Played an active role in helping to refine and execute the Nanofabrication Research Laboratory's plan for handling user load.

November 2004 – December 2007
Research Assistant Professor, The University of Tennessee, Knoxville
Molecular – Scale Engineering and Nanoscale Technologies Research Group (MENT) member

- Cellular mimetic research integrating standard lithography patterning techniques to produce structures mimicking passive, diffusion based, molecular transport across membrane structures on the nanoscale
- Cell mimic simulation software for Monte Carlo simulations to complement all passive diffusion experiment configurations including fluorescence recovery after photobleaching, enzyme functionalized CNF membrane experiments, and fluorescence microscopy characterization-based techniques
- Intracellular, carbon nanofiber-based probe fabrication for cell impalefection for the delivery of tethered, functional DNA delivery into the intracellular cytoplasm and nucleus.
- Control of catalyst nanoparticle crystallographic texture by rf magnetron sputtering to deterministically control vertically aligned carbon nanofiber growth over macroscopic, silicon wafer dimensions

August 2002 – October 2004
Post – Graduate Research Assistant

- Electron beam – induced, nanoscale etching in semiconductor and oxide materials for future use in EUV mask repair and integrated circuit repair.
- Developed a detailed 3D computer simulation of electron – beam stimulated deposition and etching including localized precursor gas delivery, surface diffusion, electron stimulated deposition, and beam rastering.
- Film crystal structure and morphology via x – ray diffraction to determine the effects of these properties on the ultraviolet luminescence of magnetron sputtered gadolinium doped yttrium oxide thin films and gadolinium doped yttrium – aluminum garnet thin films
- Developed a numerical simulation to aide in the interpretation of cathodoluminescence characterization results
- Combinatorial deposition, using magnetron sputtering, of binary alloy systems for rapid material properties determination

May 1997 – August 2002
Graduate Research Assistant
Laboratory Preparation

- Assembled several vacuum chamber systems for pulsed – laser deposition processing and laser surface modification experiments
- General laboratory maintenance on chambers, pumping systems, vacuum gauges, excimer laser, etc.
- Knowledge of optical components for laser beam delivery

Research Work

- Experiments and theory development of the catalyst – free vapor – liquid – solid process of silicon microcone/microcolumn growth via laser irradiation
- Photoluminescent silicon and silicon – oxide nanoparticles grown via laser irradiation of silicon microcone/microcolumn morphologies
- Characterized silicon nanoparticle morphology and properties using AFM, HRSEM, and HRTEM
- Self – organization of silicon nanostructures over microscopic dimensions
- Pulsed – laser deposition of silicon nanoparticle films

- Laser–assisted chemical vapor deposition of silicon nano –tips

Current Research Synopsis

1. *Charged Particle Beam-Induced, Direct-Write Deposition/Etching*
   Nanoscale direct-write assembly methods, such as focused particle beam processing, require precise understanding and control of the relevant electron/ion–vapor precursor–solid interactions where energy beams on the order of 1–10 nm dictate the assembly/removal of material at the confluence of the particle beam, adsorbed precursor and substrate. We determine precursor–substrate interaction parameters relevant for the electron/ion beam induced deposition methods through a combination of experiments and simulations. Monte Carlo simulations of the electron–substrate interaction are combined with finite difference simulations of precursor–substrate interactions to unravel the parameters by fitting to experimental results.

2. *Self and Directed Assembly of Thin, Liquid Metallic Films*
   Physical vapor deposition combined with nanolithography methods are used to deposit metallic materials with highly non-equilibrium shapes. Capillary, inertial and viscous forces dictate the mass transport of the metal once liquefied. The initial shape of the metallic feature is used to harness liquid surface instabilities for the self-assembly of metallic nanoparticles. Pulsed laser irradiation is used to liquefy the metal features where rapid heating and cooling rates and nanosecond melt lifetimes are achievable. Directed assembly is possible by imposing periodic fluctuations onto the initial metal geometry which translates into highly precise arrays of metallic nanoparticles/nanocaps.

3. *Solute Diffusion in Crowded Environments*
   Biomolecular transport in cellular environments occurs in crowded surroundings where molecular reactivity and diffusion can be significantly altered when compared with dilute solution conditions. By the prescribed design of spatially restricted environments, micro- and nanofabrication techniques can be used to replicate specific features of such systems. We implement Monte Carlo, Brownian based simulation methods to design, and fabricate, micro- and nano- size containers and crowding features intended to control the reaction and diffusion of matter at biologically relevant length and time scales.

Peer-Reviewed Publications

1. O. Dyck, L. Zhang, M. Yoon, J. Swett, D. Hensley, C. Zhang, P. Rack, J. D. Fowlkes, A. Lupini, S. Jesse, “Doping Transition–Metal Atoms in Graphene for Atomic–Scale Tailoring of Electronic, Magnetic, and Quantum Topological Properties” *ACS Nano* (*submitted*)
2. D. A. Garfinkel, G. Pakeltis, N. Tang, I. N. Ivanov, **J. D. Fowlkes**, D. A. Gilbert, P. D. Rack, “Optical and Magnetic Properties of Ag–Ni Bimetallic Nanoparticles Assembled via Pulsed Laser–Induced Dewetting” *ACS Omega* 5, 19285 (2020)
3. A. Belianinov, M. J. Burch, A. Ievlev, S. Kim, M. G. Stanford, K. Mahady, B. B. Lewis, **J. D. Fowlkes,** P. D. Rack, O. S. Ovchinnikova, “Direct Write of 3D Nanoscale Mesh Objects

with Platinum Precursor via Focused Helium Ion Beam Induced Deposition" *Micromachines* 11, 527 (2020)

4. O. Dyck, C. Zhang, P. Rack, **J. D. Fowlkes**, B. Sumpter, A. R. Lupini, S. V. Kalinin, S. Jesse, "Electron-beam Introduction of Heteroatomic Pt-Si Structures in Graphene", *Carbon* 161, 750 (2020)
5. M. Stanford, C. Zhang, **J. D. Fowlkes**, A. N. Hoffman, I. N. Ivanov, P. D. Rack and J. M. Tour, "High–Resolution Laser–Induced Graphene. Flexible Electronics Beyond the Visible Limit", *ACS Applied Materials & Interfaces* 12, 10902 (2020)
6. R. Winkler, J. Sattelkow, D. Kuhnes, C. Schwalb, S. Hummel, O. Domanov, **J. D. Fowlkes**, P. D. Rack, I. Utke and H. Plank, "Focused Electron Beam based 3D Nanoprinting for Scanning Probe Microscopy: A Review", *Micromachines* 11, 48 (2020)
7. **J. D. Fowlkes(*)**, R. Winkler, E. Mutunga, P. Rack and H. Plank, "Simulation Informed CAD for 3D Nanoprinting", *Micromachines* 11, 8 (2020)
8. A. N. Hoffman, Y. Gu, L. Liang, **J. D. Fowlkes**, K. Xiao and P. D. Rack, "Exploring the air stability of $PdSe_2$ via electrical transport measurements and defect calculations", *Scientific Reports* 3, 50 (2019)
9. G. Pakeltis, Z. Hu, A. G. Nixon, E. Mutunga, C. Praise Anyanwu, C. A. West, J. C. Idrobo, H. Plank, D. J. Masiello, **J. D. Fowlkes** and P. D. Rack, "Focused Electron Beam Induced Deposition Synthesis of 3D Photonic and Magnetic Nanoresonators", *ACS Applied Nano Materials*, 2, 8075 (2019)
10. C. Zhang, O. Dyck, D. A. Garfinkel, M. G. Stanford, A. A. Belianinov, **J. D. Fowlkes**, S. Jesse and P. D. Rack, "Pulsed Laser–Assisted Helium Ion Nanomachining of Monolayer Graphene – Direct–Write Kirigami Patterns", *Nanomaterials* 9, 1394 (2019)
11. L. Kondic, A. G. González, J. A. Diez, **J. D. Fowlkes** and P. D. Rack, "Liquid–State Dewetting of Heated Metal Films and Other Geometries on Nanoscale", *Annual Reviews* 52, 235 (2020)
12. R. Winkler, **J. D. Fowlkes**, P. D. Rack and H. Plank, "Perspective: 3D Nanoprinting via Focused Electron Beams", *Journal of Applied Physics* 125, 210901 (2019)
13. C. Zhang, **J. D. Fowlkes**, et al., "Low Temperature Charging Dynamics of Ionic Liquid and Its Gating Effect on FeSe0.5Te0.5 Superconducting Films", *ACS Applied Materials & Interfaces* 11, 17979 (2019)
14. E. Mutunga, R. Winkler, J. Sattelkow, P. D. Rack, H. Plank and **J. D. Fowlkes**(*), "The Impact of Electron Beam Heating during 3D Nanoprinting", *ACS Nano* 13, 5198 (2019)
15. J. A. Aufrecht, **J. D. Fowlkes**, A. N. Bible, J. Morrell–Falvey, M. Doktycz, S. T. Retterer, "Pore–Scale Hydrodynamics Influence the Spatial Evolution of Bacterial Biofilms in a Microfluidic Porous Network", accepted *PLOS ONE*
16. I. Cuellar, P. D. Ravazzoli, J. A. Diez, A. G. González, N. A. Roberts, **J. D. Fowlkes**, P. D. Rack and L. Kondic, "Self–assembly of a drop pattern from a two–dimensional grid of nanometric metallic filaments", *Physical Review E* 98, 043101 (2018)
17. D. Sanz–Hernández, R. F. Hamans, J. Osterrieth, J.–W. Liao, L. Skoric, **J. D. Fowlkes**, P. D. Rack, A. Lippert, S. F. Lee, R. Lavrijsen and A. Fernández–Pacheco, "Fabrication of Scaffold–Based 3D Magnetic Nanowires for Domain Wall Applications", *Nanomaterials* 8, 483 (2018)
18. B. C. White, A. Behbahanian, T. McKay Stoker, **J. D. Fowlkes**, C. Hartnett, P. D. Rack and N. A. Roberts, "The effect of different thickness alumina capping layers on the final morphology of dewet thin Ni films", *Applied Physics A* 124, 233 (2018)

19. G. Arnold, R. Winkler, M. Stermitz, A. Orthacker, J.–H. Noh, **J. D. Fowlkes**, G. Kothleitner, M. Huth, P. D. Rack and H. Plank, “Tunable 3D Nanoresonators for Gas – Sensing Applications”, *Advanced Functional Materials* 28, 1707387 (2018)
20. R. Winkler, B. B. Lewis, **J. D. Fowlkes**(*****), P. D. Rack and H. Plank, “High–Fidelity 3D–Nanoprinting via Focused Electron Beams: Growth Fundamentals”, *ACS Applied Nano Materials* 1, 1014 (2018)
21. **J. D. Fowlkes**(*****), R. Winkler, B. B. Lewis, A. Fernández–Pacheco, L. Skoric, D. Sanz–Hernández, M. G. Stanford, E. Mutunga, P. D. Rack and H. Plank, “High–Fidelity 3D–Nanoprinting via Focused Electron Beams: Computer-Aided Design (3BID)”, *ACS Applied Nano Materials* 1, 1028 (2018)
22. B. B. Lewis, B. A. Mound, B. Srijanto, **J. D. Fowlkes**(*****), G. M. Pharr and P. D. Rack, “Growth and nanomechanical characterization of nanoscale 3D architectures grown via focused electron beam induced deposition”, *Nanoscale* 9, 16349 (2017)
23. C. Hartnett, I. Seric, K. Mahady, L. Kondic, S. Afkhami, **J. D. Fowlkes** and P. D. Rack, “Exploiting the Marangoni effect to initiate instabilities and direct the assembly of liquid metal filaments” *Langmuir* 33, 8123 (2017)
24. K. Mahady, S. Tan, Y. Greenzweig, R. Livengood, A. Raveh, **J. D. Fowlkes** and P. D. Rack, “Monte Carlo simulations of secondary electron emission due to ion beam milling”, *Journal of Vacuum Science & Technology B* 35, 041805 (2017)
25. Q. Zhang, Z. Cui, Z. Wei, S. Y. Chang, L. Yang, Y. Zhao, Y. Yang, Z. Guan, **J. Fowlkes**, J. Yang, D. Xu, Y. Chen, T. T. Xu and D. Li, “Defect Facilitated Phonon Transport through Kinks in Boron Carbide Nanowires”, *Nano Letters* 17, 3550 (2017)
26. M. G. Stanford, B. B. Lewis, K. Mahady, **J. D. Fowlkes** and P. D. Rack, “Advanced nanoscale patterning and materials synthesis with gas field helium and neon beams”, *Journal of Vacuum Science & Technology B* 35, 030802 (2017)
27. B. B. Lewis, R. Winkler, X. Sang, P. R. Pudasaini, M. G. Stanford, H. Plank, R. R. Unocic, **J. D. Fowlkes**, P. D. Rack, “3D Nanoprinting via laser-assisted electron beam induced deposition: growth kinetics, enhanced purity and electrical resistivity”, *Beilstein Journal of Nanotechnology* 8, 801 (2017)
28. R. Winkler, F. Schmidt, U. Haselmann, **J. D. Fowlkes**, B. B. Lewis, G. Kothleitner, P. D. Rack, H. Plank, “Direct-Write 3D-Nanoprinting of Plasmonic Structures”, *ACS Applied Materials & Interfaces* 9, 8233 (2017)
29. M. G. Stanford, K. Mahady, B. B. Lewis**, J. D. Fowlkes**, S. Tan, R. Livengood, G. A. Magel, T. M. Moore, and P. D. Rack, “Laser-Assisted Focused He^+ Ion Beam Induced Etching with and without XeF_2 Gas Assist”, *ACS Applied Materials & Interfaces* 8, 29155 (2016)
30. S. Jesse, A. Y. Borisevich, **J. D. Fowlkes**, A. R. Lupini, P. D. Rack, R. Unocic, B. G. Sumpter, S. V. Kalinin, A. Belianinov and O. S. Ovchinnikova, “Directing Matter: Toward Atomic-Scale 3D Nanofabrication”, *ACS Nano* 10, 5600 (2016)
31. **J. D. Fowlkes**, R. Winkler, B. B. Lewis, M. G. Stanford, H. Plank and P. D. Rack, “Simulation guided 3D nanomanufacturing via focused electron beam induced deposition”, *ACS Nano* 10, 6163 (2016)
32. M – W. Lin, I. I. Kravchenko, **J. Fowlkes**, X. Li, A. A. Puretzky, C. M. Rouleau, D. B. Geohegan and K. Xiao, “Thickness Dependence with Transition Temperature of Mobility in Few–Layer MoS_2 Field–Effect Transistors”, *Nanotechnology*, 27, 165203 (2016)

33. X. Li, M. –W. Lin, J. Lin, B. Huang, A. A. Puretzky, C. Ma, K. Wang, W. Zhou, S. T. Pantelides, M. Chi, I. Kravchenko, **J. Fowlkes**, C. M. Rouleau, D. B. Goehegan and K. Xiao, "Two–dimensional GaSe/$MoSe_2$ Misfit Bilayer Heterojunctions by van der Waals Epitaxy", *Science Advances* 2, e1501882 (2016)
34. M. G. Stanford, B. B. Lewis, V. O. Iberi, **J. D. Fowlkes**, S. Tan, R. Livengood and P. D. Rack, "In–situ mitigation of sub–surface and peripheral focused ion beam damage via simultaneous pulsed laser heating", *Small* 12, 1779 (2016) *Journal Cover*
35. C. Hartnett, K. Mahady, **J. D. Fowlkes**, S. Afkhami, L. Kondic and P. D. Rack, "Instability of Nano– and Microscale Liquid Metal Filaments: Transition from Single Droplet Collapse to Multidroplet Breakup", *Langmuir* 31, 13609 (2015)
36. M. G. Stanford, B. B. Lewis, J. H. Noh, **J. D. Fowlkes** and P. D. Rack, "Inert Gas Enhanced Laser–Assisted Purification of Platinum Electron-Beam-Induced-Deposits", *ACS Applied Materials and Interfaces* 7, 19579 (2015)
37. **J. D. Fowlkes**, B. Geier, B. Lewis, P. D. Rack, M. Stanford, R. Winkler and H. Plank, "Electron nanoprobe induced oxidation: a simulation of direct–write purification", *Physical Chemistry and Chemical Physics* 17, 18294 (2015) *Journal Cover*
38. B. B. Lewis, M. G. Stanford, **J. D. Fowlkes**, K. Lester, H. Plank and P. D. Rack, "Electron Stimulated Purification of Platinum Nanostructures Grown Via Focused Electron Beam Induced Deposition", *Beilstein Journal of Nanotechnology* 6, 907 (2015)
39. J. H. Noh, **J. D. Fowlkes**, R. Timilsina, M. Stanford, B. Lewis and P. D. Rack, "Pulsed laser assisted focused electron beam induced etching of titanium with XeF_2: enhanced reaction rate and precursor transport", *ACS Applied Materials and Interfaces* 7, 4179 (2015)
40. R. Winkler, A. Szkudlarek, **J. D. Fowlkes**, P. D. Rack, I. Utke and H. Plank, "Toward Ultrafast Surface Morphologies During Focused Electron Beam Induced Nanosynthesis: Disruption Origins and Compensation", *ACS Applied Materials and Interfaces* 7, 2389 (2015)
41. R. Schmied, **J. D. Fowlkes**, R. Winkler, P. D. Rack and H. Plank, "Fundamental edge broadening effects during focused electron beam induced nanosynthesis", *Beilstein Journal of Nanotechnology* 6, 462 (2015)
42. J. T. McKeown, Y. Wu, **J. D. Fowlkes**, P. D. Rack and G. H. Campbell, "Simultaneous In Site Synthesis and Characterization of Co@Cu Core–Shell Nanoparticle Arrays", *Advanced Materials* 27, 1060 (2015)
43. C. Durand, X. –G. Zhang, **J. D. Fowlkes**, S. Najmaei, J. Lou and A. –P. Li, "Defect – mediated transport and electronic irradiation effect in individual domains of CVD – grown monolayer MoS_2", *Journal of Vacuum Science & Technology B* 33, 02B110 (2015)
44. M. G. Stanford, B. B. Lewis, J. H. Noh, **J. D. Fowlkes**, N. A. Roberts, H. Plank and P. D. Rack, "Purification of nanoscale electron beam induced platinum deposits via pulsed laser induced oxidation reaction", *ACS Applied Materials and Interfaces* 6, 21256 – 21263 (2014)
45. L. Kondic, N. Dong, Y. Wu, **J. D. Fowlkes** and P. D. Rack, "Instabilities of nanoscale patterned metal films", *European Physics Journal Special Topics* 224, 369 (2015)
46. B. Geier, C. Gspan, R. Winkler, R. Schmied, **J. D. Fowlkes**, Harald Fitzek, S. Rauch, J. Rattenberger, P. D. Rack and H. Plank, "Rapid and highly compact purification for focused electron beam induced deposits: a low temperature approach using electron stimulated H_2O reactions", *Journal of Physical Chemistry C* 118, 14009 (2014)

47. J. H. Noh, M. G. Stanford, B. B. Lewis, **J. D. Fowlkes**, H. Plank and P. D. Rack, "Nanoscale electron beam induced deposition and purification of ruthenium for extreme ultraviolet lithography mask repair*"*, *Applied Physics A* 117, 1705 (2014)

48. D. C. Skigin, **J. D. Fowlkes**, N. A. Roberts, L. Scaffardi, D. Schinca and M. Lester, "Experimental demonstration of the ability of dual–period wire gratings to control the optical response", *Optics Letters 39*, 5693 (2014)

49. T. D. Nguyen, M. Fuentes–Cabrera, **J. D. Fowlkes** and P. D. Rack, "Coexistence of spinodal instability and thermal nucleation in thin film rupture: Insights from molecular levels", *Physical Review E* 89, 032403 (2014)

50. Y. Wu, S. Fu, J. D. Fowlkes, N. Dong, L. Kondic, M. A. Vincenti, D. de Cegia and P. D. Rack, " Directed liquid phase assembly of highly ordered metallic nanoparticle arrays", *ACS Applied Materials & Interfaces* 6, 5835 (2014)

51. G. Arnold, R. Timilsina, J. Fowlkes, A. Orthacker, G. Kothleitner, P. D. Rack and H. Plank, "Fundamental resolution limits during electron-induced direct-write synthesis", *ACS Applied Materials & Interfaces* 6, 7380 (2014)

52. R. Winkler, **J. D. Fowlkes**, A. Szkudlarek, I. Utke, P. D. Rack and H. Plank, "The Nanoscale Implications of a Molecular Gas Beam during Electron Beam Induced Deposition", *ACS Applied Materials & Interfaces* 6, 2987 (2014)

53. **J. D. Fowlkes**, N. A. Roberts, Y. Wu., J. A. Diez, A. G. Gonzalez, C. Hartnett, K. Mahady, S. Afkhami, L. Kondic and P. D. Rack, "Hierarchical nanoparticle ensembles synthesized by liquid phase directed self–assembly", *Nano Letters* 14, 774 (2014)

54. H. Plank, J. H. Noh, **J. D. Fowlkes**, B. Lewis, K. Lester and P. D. Rack, "Electron beam assisted oxygen purification at low temperatures of electron beam induced Pt deposits: towards pure and pore–free structures", *ACS Applied Materials & Interfaces* 6, 1018 (2014)

55. W. Siemons, C. Beekman, **J. D. Fowlkes**, N. Balke, J. Z. Tischler, R. Xu, W. Liu, C. M. Gonzalez, J. D. Budai and H. M. Christen, "*Focused–Ion–Beam induced damage in thin films of complex oxide* $BiFeO_3$", *APL Materials* 2, 022109 (2014)

56. N. A. Roberts, C. M. Gonzalez, **J. D. Fowlkes** and P. D. Rack, "Enhanced By – product Desorption via Laser Assisted Electron Beam Induced Deposition of $W(CO)_6$ with Enhanced Conductivity and Resolution", *Nanotechnology* 24, 415301 (2013)

57. N. P. Mortensen, N. Boisen, S. Carey, S. J. Kennel, **J. D. Fowlkes**, M. J. Doktycz, J. P. Nataro and D. P. Allison, "Enteroaggregative Escherichia coli: Surface Protein Dispersin Increases Bacterial Uptake of Ciprofloxacin", *International Journal of Antimicrobial Agents* 42, 462 (2013)

58. A. G. Gonzalez, J. A. Diez, Y. Wu, **J. D. Fowlkes**, P. D. Rack and L. Kondic, "Instability of Liquid Cu Films on a SiO_2 Substrate", *Langmuir* 29, 9378 (2013)

59. N. A. Roberts, **J. D. Fowlkes**, K. Mahady, S. Afkhami, L. Kondic and P. D. Rack, "Directed assembly of one – and two – dimensional nanoparticle arrays from pulsed laser induced dewetting of square waveforms", *ACS Applied Materials & Interfaces* 5, 4450 (2013)

60. **J. D. Fowlkes** and P. C. Collier, "Single-molecule mobility in confined and crowded femtoliter chambers", *Lab on a Chip* 13, 877 (2013)

61. N. A. Roberts, **J. D. Fowlkes**, G. A. Magel and P. D. Rack, "Enhanced materials purity and resolution via synchronized laser assisted electron beam induced deposition of platinum", *Nanoscale* 5, 410 (2013)

62. J. T. McKeown, N. A. Roberts, **J. D. Fowlkes**, Y. Wu, T. LaGrange, B. W. Reed, G. H. Campbell and P. D. Rack, “Real-time observation of nanosecond liquid-phase assembly of nickel nanoparticles via pulsed-laser heating”, *Langmuir* 28, 17168 (2012)
63. **J. D. Fowlkes**, L. Kondic, J. A. Diez, A. G. Gonzalez, Y. Wu, N. A. Roberts, C. E. McCold and P. D. Rack, “Parallel assembly of particles and wires on substrates by dictating instability evolution in liquid metal films”, *Nanoscale* 4, 7376 (2012)
64. T. D. Nguyen, M. Fuentes–Cabrera, **J. D. Fowlkes**, J. A. Diez, A. G. Gonzalez, L. Kondic and P. D. Rack, “Competition between Collapse and Breakup in Nanometer – Sized Thin Rings Using Molecular Dynamics and Continuum Modeling”, *Langmuir* 28, 13960 (2012)
65. **J. D. Fowlkes**, S. Horton, M. Fuentes–Cabrera and P. D. Rack, “Signatures of the Rayleigh–Plateau Instability Revealed by Imposing Synthetic Perturbations on Nanometer–Sized Liquid Metals on Substrates”, *Angewandte Chemie International Edition* 51, 8768 (2012)
66. W. Wang, Z. Gai, M. Chi, **J. D. Fowlkes**, J. Yi, L. Zhu, X. Cheng, D. J. Keavney, P. C. Snijders, T. Z. Ward, J. Shen and X. Xu, “Growth diagram and magnetic properties of hexagonal LuFe2O4 thin films”, *Physical Review B* 85, 155411 (2012)
67. N. A. Roberts, G. A. Magel, C. D. Hartfield, T. M. Moore, **J. D. Fowlkes** and P. D. Rack, “In situ laser processing in a scanning electron microscope”, *Journal of Vacuum Science and Technology A* 30, 041404 (2012)
68. Y. Wu, **J. D. Fowlkes**, N. A. Roberts, J. A. Diez, L. Kondic, A. G. Gonzalez and P. D. Rack, “Competing liquid phase instabilities during pulsed laser induced self–assembly of copper rings into ordered nanoparticle arrays on SiO_2”, *Langmuir* 27, 13314 (2011)
69. M. Fuentes–Cabrera, B. R. Rhodes, M. I. Baskes, H. Terrones, **J. D. Fowlkes**, M. L. Simpson and P. D. Rack, “Controlling the Velocity of Jumping Nanodroplets via Their Initial Shape and Temperature”, *ACS Nano* 5, 7130 (2011)
70. N. P. Mortensen, **J. D. Fowlkes**, M. Maggart, M. J. Doktycz, J. P. Nataro, G. Drusano and D. P. Allision, “Effects of sub–minimum inhibitory concentrations of ciprofloxacin on enteroaggregative Escherichia Coli and the role of the surface protein dispersin”, *International Journal of Antimicrobial Agents* 38, 27 (2011)
71. **J. D. Fowlkes**, L. Kondic, J. Diez, Y. Wu and P. D. Rack, “Self–Assembly versus Directed Assembly of Nanoparticles via Pulsed Laser Induced Dewetting of Patterned Metal Films”, *Nano Letters* 11, 2478 (2011)
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PRINCIPAL INVESTIGATOR

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Design and Synthesis of Nanomaterials, $470k/yr (2011–2013)

ACTIVITES IN PROFESSIONAL MEETINGS AND CONFERENCES

American Vacuum Society (AVS) Member
Materials Research Society (MRS) Member
American Association for the Advancement of Science Member

Materials Research Society (MRS) Fall 2019
2019 International Meeting

J. D. Fowlkes, E. Mutunga, R. Winkler, J. Sattelkow, G. Pakeltis, P. Rack, A. Belianinov, O. S. Ovchinnikova and H. Plank, “3D Nanoprinting Using Electron and Ion Beams”, **Invited Talk**, Boston, Massachusetts, USA, December

Materials Science and Technology (MS&T) 2019
2019 International Meeting
J. D. Fowlkes, R. Winkler, E. Mutunga, J. Sattelkow, P. D. Rack and H. Plank, “3D Nanoprinting: An Integrated Approach of Experiments, CAD and Simulations”, **Invited Talk**, Portland, Oregon, USA, October

2nd ELENA Conference
(Low energy **ELE**ection driven chemistry for the advantage of emerging **NA**no-fabrication methods)
2019 International Meeting
J. D. Fowlkes, R. Winkler, A. Fernández-Pacheco, E. Mutunga, J. Sattelkow, P. D. Rack and H. Plank, “3D Nano-printing using Focused Electron Beam Induced Deposition”, **Invited Talk**, Leuven, Belgium, September

AVS 65st International Symposium & Exhibition
2018 International Meeting
J. D. Fowlkes, R. Winkler, B. B. Lewis, A. Fernandéz–Pacheco, L. Skoric, D. Sanz–Hernandéz, M. G. Stanford, E. Mutunga, P. Rack and H. Plank, “3D Nanoprinting using an Electron Beam: Simulations and Computer–Aided Design”, **Invited Talk**, Long Beach, California, USA, October

7th International Workshop on Focused Electron Beam Induced Processing (FEBIP 2018)
J. D. Fowlkes, B. B. Lewis, B. A. Mound, B. Srijanto, G. M. Pharr, E. Mutunga, R. Winkler, P. D. Rack and H. Plank, “Nanomechanical Characterization of 3D FEBID Nanostructures”, **Invited Talk**, Modena, Italy, July

Duetsche Physikalische Gesellschaft (DPG) Spring Meeting 2018
J. D. Fowlkes, R. Winkler, E. Mutunga, B. Lewis, H. Plank and P. Rack, “3D Direct–Write Nanofabrication using an Electron Beam”, **Invited Talk**, Berlin, Germany, March

Graz University of Technology (TU Graz) 2017
J. D. Fowlkes, R. Winkler, B. B. Lewis, M. G. Stanford and H. Plank/P. Rack, “3D Nanoprinting using Focused Electron Beam–Induced Deposition (FEBID)”, **Invited Seminar**, Graz, Austria, October

Physical Science Directorate (ORNL) 2017
J. D. Fowlkes, R. Winkler, B. B. Lewis, M. G. Stanford and H. Plank/P. Rack, “3D Nanoprinting using Focused Electron Beam–Induced Deposition (FEBID)”, **Invited Seminar**, Oak Ridge, Tennessee, USA, September

61st International Conference on Electron, Ion, Photon Beam Technology and Nanofabrication

2017 International Meeting
J. D. Fowlkes, B. B. Lewis, E. Mutunga, P. D. Rack, M. G. Stanford, H. Plank and R. Winkler, "Three–Dimensional Focused Electron Beam induced Deposition: Design, Simulation and Experiments", **Invited Talk**, Orlando, Florida, USA, May

CELINA Training School 2016
Tutorials on FEBIP Modeling, Technical Setup, Patterning, and Applications", Tutorial IV "Overview of Purification Strategies for Electron Beam Induced Deposition", **Invited Talk**, Vienna, Austria, July

10th Anniversary Workshop on Focused Electron Beam Induced Processing (FEBIP 2016)
J. D. Fowlkes, P. D. Rack, M. G. Stanford, B. B. Lewis, S. Tan and R. Livengood, "Laser Assisted Focused Beam Induced Processing", **Invited Talk**, Vienna, Austria, July

10th Anniversary Workshop on Focused Electron Beam Induced Processing (FEBIP 2016)
J. D. Fowlkes, R. Winkler, B. B. Lewis, M. G. Stanford, H. Plank and P. D. Rack, "Three-Dimensional FEBID", **Invited Talk**, Vienna, Austria, July

Graz University of Technology (TU Graz) 2014
1 month funded invited visit to co-develop a focused electron beam induced processing simulation with a CNMS User (H. Plank)

15th International Symposium on Laser Precision Microfabrication 2014
J. D. Fowlkes, J. A. Diez, A. G. Gonzalez, L. Kondic, K. Mahady, S. Afkhami, Y. Wu, N. A. Roberts and P. D. Rack, "Metal nanoparticle self–organization by pulsed laser melting and nanolithography", **Invited Talk**, 15th International Symposium on Laser Precision Microfabrication, Vilnius, Lithuania, June

SPIE Photonics West 2014
J. D. Fowlkes, P. D. Rack, Y. Wu, N. Roberts, J. Diez, A. Gonzalez, and L. Kondic, "The Liquid Phase Assembly of Metallic Nanoparticle Arrays using Nanolithography and Pulsed Laser Melting", **Invited Talk**, San Francisco, CA, February

Frontiers in Applied and Computational Mathematics 2012
J. D. Fowlkes, P. D. Rack, Y. Wu, N. Roberts, J. Diez, A. Gonzalez, and L. Kondic, "The Directed Assembly of Linear Metallic Nanoparticle Chains by Nanolithography and Pulsed Laser Induced Dewetting", **Invited Talk**, Newark, NJ, May

Directed Self-Assembly of Materials
MRS Workshop
J. D. Fowlkes, P. D. Rack, J. Diez, L. Kondic, Y. Wu and N. Roberts, "The Directed Assembly of Linear Metallic Nanoparticle Chains by Nanolithography and Pulsed Laser Induced Dewetting", **Talk**, Nashville, TN, September

Synthesis and Processing Principal Investigators' Meeting 2011
J. D. Fowlkes, P. D. Rack, M. Fuentes-Cabrera, "Design and Synthesis for Nanomaterials", **Talk**, Washington D.C., September

55th International Conference on Electron, Ion, Photon Beam Technology and Nanofabrication
2011 International Meeting
J. D. Fowlkes, L. Kondic, J. Diez, Y. Wu and P. D. Rack, "The Directed Assembly of Metallic Nanoparticle Chains by Pulsed Laser Induced Dewetting and Nanolithography", **Talk**, Las Vegas, Nevada, USA, June

American Physical Society March Meeting 2011
Y. Wu, J. D. Fowlkes, P. Rack, L. Kondic, and J. Diez, "Self and Directed Assembly of Thin Metallic Films Exposed to Pulsed Laser Irradiation, Talk, Dallas, TX, March

3rd International Workshop on Focused Electron Bead Induced Processing
2010 International Meeting
(Conference co-organizer)
P. D. Rack, M. J. Doktycz, S. T. Retterer and M. L. Simpson, "Fundamental electron–precursor–solid interactions derived from time–dependent electron beam induced deposition simulations and experiments", **Poster**, Albany, New York, USA, July

Microscopy & Microanalysis 2009
J. D. Fowlkes, D. A. Smith, M. J. Doktycz, M. L. Simpson and P. D. Rack, "Electron beam induced deposition: experiments, challenges and nano–based applications", **Invited Talk**, Richmond, July

American Society for Microbiology 109th General Meeting
2009 International Meeting
A. N. Edwards, J. D. Fowlkes, R. F. Standaert, D. A. Pelletier, M. J. Doktycz, J. L. Morrell–Falvey, "A FRAP – based method for Quantification of Binding Affinities *In vivo*", **Poster**, Philadelphia, May

53rd International Conference on Electron, Ion, Photon Beam Technology and Nanofabrication
2009 International Meeting
J. D. Fowlkes, M. Fuentes – Cabrera, J. A. Diez, L. Kondic, A. V. Melechko, R. Kalyanaraman, H. Krishna, Y. Wu and P. D. Rack, "Directed, Liquid Phase Assembly of Patterened, Thin Metallic Films by Pulsed Laser Dewetting", **Poster**, Marco Island, May

Microscopy & Microanalysis 2008
J. D. Fowlkes, D. A. Smith, M. J. Doktycz, M. L. Simpson and P. D. Rack, "Electron beam induced processing: Experimentation, Simulation and Applications", **Invited Talk**, Albuquerque, August

2nd International Workshop on Focused Electron Bead Induced Processing

2008 International Meeting
J. D. Fowlkes, P. D. Rack, M. J. Doktycz, S. T. Retterer and M. L. Simpson, "Electron stimulated materials processing for nanofabrication and bio – inspired synthesis", **Poster**, Thun, Switzerland, July 2008

52nd International Conference on Electron, Ion, Photon Beam Technology and Nanofabrication
2008 International Meeting
J. D. Fowlkes and P. D. Rack, "Electron beam induced deposition efficiency", **Poster**, Portland, OR, June

1st International Workshop on Electron Beam Induced Deposition
2006 International Meeting
P. D. Rack, D. A. Smith, **J. D. Fowlkes**, D. C. Joy, "Understanding electron–beam–induced deposition and etching via a Monte – Carlo based, 3D growth simulation: 'Envizion'", **Talk**, Delft, Netherlands, June

52nd International American Vacuum Society
2005 International Meeting
The Focused Beam Processing and Fabrication Session (moderator)
J. D. Fowlkes, B. L. Fletcher, E. D. Hullander, K. L. Klein, T. E. McKnight, M. L. Simpson, and M. J. Doktycz, "A Cell Mimic Structure with Tailored Pore Sizes: Synthesis and Modeling", **Poster**, Boston, MA, November

49th International Conference on Electron, Ion, Photon Beam Technology and Nanofabrication
2005 International Meeting
J. D. Fowlkes, S. J. Randolph, and P. D. Rack, "Unraveling the complex variable space of electron beam induced deposition (EBID) by a Monte Carlo based, 3D growth simulation", **Poster**, Orlando, FL, June

Gordon Research Conference
Combinatorial & High Throughput Materials Science 2004
J. D. Fowlkes and P. D. Rack, "Combinatorial Thin Film Synthesis via Multi – Source RF Magnetron Sputtering", **Poster**, Buellton, CA, January

51st International American Vacuum Society
2004 International Meeting
J. D. Fowlkes, S. J. Randolph, and P. D. Rack, "A Three – Dimensional Computer Simulation of Electron – Beam Induced Deposition (EBID)", **Talk**, Anaheim, CA, November

50th International American Vacuum Society
2003 International Meeting
J. D. Fowlkes, P. D. Rack, and J. M. Fitz – Gerald, "Gadolinium – Doped Yttrium Oxide Thin Films Deposited by Radio – Frequency Magnetron Sputtering; Film Quality and Cathodoluminescence Properties", **Talk**, Baltimore, MD, November

Materials Research Society
2003 MRS Spring Meeting
J.D. Fowlkes, P.D. Rack, Y. Deng, S. Allison, and J.M. Fitz-Gerald “Gadolinium – Doped Yttrium Oxide Ultraviolet Emitting Materials”, **Talk**, San Francisco, CA, April

J.M. Fitz-Gerald, R. Bansal, J. Hoekstra, **J.D. Fowlkes**, and P.D. Rack, “Temperature Dependent Cathodoluminescence Characterization of Multi-Layer Ultraviolet Emitting Films Grown by Pulsed Laser Deposition”, **Talk**, San Francisco, CA, April

P.D. Rack, S. Randolph, Y. Deng, Y. Ko, J. Kim, **J.D. Fowlkes**, A. Thesen, and D.C. Joy, “Nanoscale Electron Beam Assisted Etching and Deposition”, **Poster**, San Francisco, CA, April

Materials Research Society
2002 MRS Fall Meeting
J.D. Fowlkes and A.J. Pedraza, "Si Nanoparticle Synthesis and Self - Organization", **Talk**, Boston, MA, December

Gordon Research Conference
Laser Interactions with Materials
J. D. Fowlkes and A. J. Pedraza, “Laser–Induced Nanostructures in Silicon”, **Poster**, Andover, N.H., July

Materials Research Society
2000 MRS Fall Meeting
J. D. Fowlkes, A. J. Pedraza, S. Jesse, C. M. Rouleau, and D. A. Blom, “Formation of Nanostructures in Silicon by Pulsed KrF Laser Irradiation”, **Talk**, Boston, MA, December

American Physical Society
1999 American Physical Society Centennial Meeting
J. D. Fowlkes and A. J. Pedraza, “Self-Organization Silicon Micro-Column Arrays Generated by Pulsed Laser Irradiation”, **Talk**, Atlanta, GA, March

TEACHING EXPERIENCE

- Introduction to Material’s Science and Engineering
- Physical Metallurgy
- Phase Transformations and Diffusion
- Laser Processing
- Thin Film Processes
- X–Ray Diffraction
- Nanoscience and Nanotechnology
- Transport Phenomena in Materials Sciences

OTHER WORK EXPERIENCE

SOUTHWEST SPECIALTY HEAT TREATMENT
Wytheville, VA May – August 1996

- Tool steel hardening heat treatment, flame hardening, and annealing

WILLIAM'S MANUFACTURING INC. Wytheville, VA
May – August 1992 – 1996

- Operation of HAAS machining center milling various tool steel components for the fastener industry and final operations to lathe/milled tool steel machined parts. Tool steel product final inspection, shipping, receiving, and inventory

STUDENT ADVISING

Eva Mutunga

SKILLS

Material's Science skills : Atomic Force Microscopy, High Resolution Scanning and Transmission Electron Microscopy, Auger Electron Spectroscopy, Grazing Incidence X-ray Diffraction, X-ray Photoelectron Spectroscopy, RF Magnetron Sputtering, Electron–Beam Stimulated Processing, Focused Ion Beam Processing, Cathodoluminescence Spectroscopy, Pulsed Laser Processing, Electron Beam Evaporation, Standard Lithographic Processes including Plasma Enhanced Chemical Vapor Deposition, Reactive Ion Etching, Contact and Step Exposure Lithography, Ink Jetting, Optical Fluorescence Microscopy, Fluorescence Recovery after Photobleaching, Electron Beam Lithography

REFERENCES

Available upon request