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EDUCATION

Ph.D., Mechanical Engineering, University of Colorado, 2002-2006
M.S., Mechanical Engineering, Boise State University, 2001-2002
B.S., Mechanical Engineering, Carnegie Mellon University, 1994-1998

RESEARCH AND INDUSTRY EXPERIENCE

Group Leader, Fatigue and Fracture, NIST, 2017-Present
Project Leader, Small-Scale Mechanics for Advanced Materials, NIST, 2014-2017
Project Leader, Nanoscale Strength Measurements and Standards, NIST, 2007-2014
Postdoctoral Researcher, Department of Chemical Engineering, University of California Berkeley, 2006-2007
Graduate Research Assistant, Department of Mechanical Engineering, University of Colorado Boulder, 2002-2006
Graduate Research Assistant, Department of Mechanical Engineering, Boise State University, 2001-2002
Product Support Engineer, C&D Aerospace (now C&D Zodiac), 1998-2001

AWARDS AND FELLOWSHIPS

Humboldt Research Fellowship for Experienced Researchers, 2020
BSU Department of Mechanical and Biomedical Engineering Outstanding Alumni Award, 2019
National Academies German-American Frontiers of Engineering Fellowship, 2019
ASME Fellow, 2018
U.S. Department of State Embassy Science Fellowship, Prague, Czech Republic, 2017
National Academies Arab-American Frontiers of Science, Engineering, and Medicine Fellowship, 2015-2016
Society for Experimental Mechanics A.J. Durelli Award, 2015
National Academies Brazil-U.S. Frontiers of Science and Engineering Fellowship, 2014
Maryland Academy of Sciences Allan C. Davis Outstanding Young Engineer Award, 2013
Adhesion Society Outstanding Young Adhesion Scientist Award, 2012
National Academies U.S. Frontiers of Engineering Fellowship, 2012
Presidential Early Career Award for Scientists and Engineers (PECASE), 2011
U.S. Department of Commerce Bronze Medal Award, 2011
TMS Young Leader Professional Development Award, 2011
ASME Leighton E. and Margaret W. Orr Early Career Award, 2009
Gordon Research Conference Carl Storm Underrepresented Minority Fellowship, 2008
University of Colorado Outstanding Ph.D. Student Award, 2006
MRS Graduate Student Award – Silver Medal, 2005
Sandia National Laboratory Microsystems and Engineering Sciences Applications Fellowship, 2004-2006
Sandia National Laboratory Engineering Sciences Summer Institute Fellowship, 2003
University of Colorado Departmental Award for Teaching Excellence, 2003
University of Colorado Outstanding Research Promise Fellowship, 2002
Carnegie Mellon University Buggy Design Competition Award – First Place, 1998
Carnegie Mellon University Merit Scholarship (full tuition, four years), 1994

BOOK CHAPTERS

6. M.P. de Boer, S. S. Shroff, F.W. DelRio, and W.R. Ashurst. Friction and wear in micro- and nanomachines. In *Springer Handbook of Nanotechnology*, fourth edition, B. Bhushan (ed.), Springer-Verlag, Berlin, Germany, 1417-1435, 2017.

5. F.W. DelRio, M.L. Dunn, and M.P. de Boer. Van der Waals and capillary adhesion of polycrystalline silicon micromachined surfaces. In *Scanning Probe Microscopy in Nanoscience and Nanotechnology*, third volume, B. Bhushan (ed.), Springer-Verlag, Berlin, Germany, 363-393, 2012.
4. F.W. DelRio and R.F. Cook. Mechanical and electrical properties of alkanethiol self-assembled monolayers: a conducting-probe atomic force microscopy study. In *Scanning Probe Microscopy in Nanoscience and Nanotechnology*, second volume, B. Bhushan (ed.), Springer-Verlag, Berlin, Germany, 439-471, 2011.
3. J. Grobelny, F.W. DelRio, N. Pradeep, D.-I. Kim, V.A. Hackley, and R.F. Cook. Size measurement of nanoparticles using atomic force microscopy. In *Methods in Molecular Medicine: Characterization of Nanoparticles Intended for Clinical Applications*, S. McNeil (ed.), Humana Press, Totowa, New Jersey, 71-82, 2011.
2. F.W. DelRio, C. Carraro, and R. Maboudian. Adhesion and surface engineering in small-scale systems. In *Tribology and Dynamics of Engine and Powertrain: Fundamentals, Applications and Future Trends*, H. Rahnejat (ed.), Woodhead Publishing, Cambridge, England, 960-989, 2010.
1. M.P. de Boer, A.D. Corwin, F.W. DelRio, and W.R. Ashurst. Friction and wear in micro- and nanomachines. In *Springer Handbook of Nanotechnology*, third edition, B. Bhushan (ed.), Springer-Verlag, Berlin, Germany, 1741-1759, 2010.

JOURNAL PUBLICATIONS

69. J.T. Benzing, L.-A. Liew, N. Hrabe, and F.W. DelRio. Tracking defects and microstructural heterogeneities in meso-scale tensile specimens excised from additively-manufactured parts. *Experimental Mechanics* (in press).
68. R.F. Cook, F.W. DelRio, and B.L. Boyce. Predicting strength distributions of MEMS structures using flaw size and spatial density. *Microsystems & Nanoengineering* **5**, 49, 2019.
67. B.-C. Tran Khac, R.M. White, F.W. DelRio, and K.-H. Chung. Layer-by-layer thinning of MoS_2 via laser irradiation. *Nanotechnology* **30**, 275302, 2019.
66. B.-C. Tran Khac, H.-J. Kim, F.W. DelRio, and K.-H. Chung. Operational and environmental conditions regulate the frictional behavior of two-dimensional materials. *Applied Surface Science* **483**, 34-44, 2019.
65. S.H. Medina, B. Bush, M. Cam, E. Sevcik, F.W. DelRio, K. Nandy, and J.P. Schneider. Identification of a mechanogenetic link between substrate stiffness and chemotherapeutic response in breast cancer. *Biomaterials* **202**, 1-11, 2019.
64. R.F. Cook and F.W. DelRio. Determination of ceramic flaw populations from component strengths. *Journal of the American Ceramic Society* **102**, 4794-4808, 2019.
63. Y. Zhu, T. Saif, and F.W. DelRio. Recent advances in micro, nano, and cell mechanics. *Experimental Mechanics* **59**, 277-278, 2019. **Invited editorial. Focus issue on Recent Advances in Micro, Nano, and Cell Mechanics.**
62. R.F. Cook and F.W. DelRio. Material flaw populations and component strength distributions in the context of the Weibull function. *Experimental Mechanics* **59**, 279-293, 2019. **Invited paper. Focus issue on Recent Advances in Micro, Nano, and Cell Mechanics.**
61. C.I. Fiedler-Higgins, L.M. Cox, F.W. DelRio, and J.P. Killgore. Monitoring fast, voxel-scale cure kinetics via sample-coupled-resonance photorheology. *Small Methods* **3**, 1800275, 2019. **In scientific media: Phys.Org, Tech Explorist, EurekaAlert, 3D Printing Industry, Science Daily.**
60. F.W. DelRio, S.D. O'Regan, P. Tuček, and R. Zbořil. U.S.-Czech conference strengthens bilateral and multidisciplinary collaborations in nanotechnology and chemistry. *Nanotechnology* **30**, 052501, 2019. **Invited perspective paper.**
59. J.P. Killgore and F.W. DelRio. Contact resonance force microscopy for viscoelastic property measurements: From fundamentals to state-of-the-art applications. *Macromolecules* **51**, 6977-6996, 2018. **Invited perspective paper. Featured paper on front cover.**
58. A. Alrasheed, J. Gorham, B.-C. Tran Khac, F. Alsaffar, F.W. DelRio, K.-H. Chung, and M.R. Amer. Surface properties of laser-treated molybdenum disulfide nanosheets for optoelectronic applications. *ACS Applied Materials & Interfaces* **10**, 18104-18112, 2018.
57. F.W. DelRio and R.A. Riggleman. Emerging investigators in materials science 2017-2018. *Materials Research Express* **5**, 040201, 2018. **Invited editorial. Focus issue on Emerging Investigators in Materials Science.**

56. G.A. MacDonald, F.W. DelRio, and J.P. Killgore. Higher-eigenmode piezoresponse force microscopy: a path towards increased sensitivity and the elimination of electrostatic artifacts. *Nano Futures* **2**, 015005, 2018. **In scientific media: NanotechWeb.**
55. B.-C. Tran Khac, F.W. DelRio, and K.-H. Chung. Interfacial strength and surface damage characteristics of atomically-thin h-BN, MoS_2 and graphene. *ACS Applied Materials & Interfaces* **10**, 9164-9177, 2018.
54. G.A. MacDonald, C.M. Heveran, M. Yang, D. Moore, K. Zhu, V.L. Ferguson, J.P. Killgore, and F.W. DelRio. Determination of the true lateral grain size in organic-inorganic halide perovskite thin films. *ACS Applied Materials & Interfaces* **9**, 33565-33570, 2017.
53. J.A. Wahlquist, F.W. DelRio, M.A. Randolph, A.H. Aziz, C.M. Heveran, S.J. Bryant, C.P. Neu, and V.L. Ferguson. Indentation mapping revealed poroelastic, but not viscoelastic, properties spanning native zonal articular cartilage. *Acta Biomaterialia* **64**, 41-49, 2017.
52. A.M. Rosales, S.L. Vega, F.W. DelRio, J.A. Burdick, and K.S. Anseth. Hydrogels with reversible mechanics to probe dynamic cell microenvironments. *Angewandte Chemie International Edition* **56**, 12132-12136, 2017.
51. M. Wang, J.M. Gorham, J.P. Killgore, M. Omidvar, H. Lin, F.W. DelRio, L.M. Cox, Z. Zhang, and Y. Ding. Formation of a crack-free, hybrid skin layer with tunable surface topography and improved gas permeation selectivity on elastomers using gel-liquid infiltration polymerization. *ACS Applied Materials & Interfaces* **9**, 28100-28106, 2017.
50. H. Ma, A.R. Killaars, F.W. DelRio, C. Yang, and K.S. Anseth. Myofibroblastic activation of valvular interstitial cells is modulated by spatial variations in matrix elasticity and its organization. *Biomaterials* **131**, 131-144, 2017.
49. S. Berweger, G.A. MacDonald, M. Yang, K.J. Coakley, J.J. Berry, K. Zhu, F.W. DelRio, T.M. Wallis, and P. Kabos. Electronic and morphological inhomogeneities in pristine and deteriorated perovskite photovoltaic films. *Nano Letters* **17**, 1796-1801, 2017.
48. F.W. DelRio and R.F. Cook. Quantitative scanning probe microscopy for nanomechanical forensics. *Experimental Mechanics* **57**, 1045-1055, 2017. **Invited paper. Focus issue on Advances in Nanoindentation. In scientific media: EurekaAlert, Talk Media News, Phys.Org, Forensic Magazine, Microscopy and Analysis. Featured paper on front cover.**
47. A.H. Aziz, J. Wahlquist, A. Sollner, V. Ferguson, F.W. DelRio, and S.J. Bryant. Mechanical characterization of sequentially layered photo-clickable thiol-ene hydrogels. *Journal of the Mechanical Behavior of Biomedical Materials* **65**, 454-465, 2017.
46. G.A. MacDonald, M. Yang, S. Berweger, J.P. Killgore, P. Kabos, J.J. Berry, K. Zhu, and F.W. DelRio. Methylammonium lead iodide grain boundaries exhibit depth-dependent electrical properties. *Energy & Environmental Science* **9**, 3642-3649, 2016. **Featured paper on back cover.**
45. R.C. Quardokus, V.K. Tewary, and F.W. DelRio. Ullmann-like reactions for the synthesis of complex two-dimensional materials. *Nanotechnology* **27**, 442501, 2016.
44. C. Yang, F.W. DelRio, L.P. Basta, H. Ma, K.A. Kyburz, A.R. Killaars, and K.S. Anseth. Spatially patterned matrix elasticity directs stem cell fate. *Proceedings of the National Academy of Sciences USA* **113**, E4439–E4445, 2016.
43. F.W. DelRio, R.M. White, S. Krylyuk, A.V. Davydov, L.H. Friedman, and R.F. Cook. Near-theoretical fracture strengths in native and oxidized silicon nanowires. *Nanotechnology* **27**, 31LT02, 2016.
42. V.K. Tewary, R.C. Quardokus, and F.W. DelRio. Green's function modeling of response of two-dimensional materials to point probes for scanning probe microscopy. *Physics Letters A* **380**, 1750-1756, 2016. **Audio slides presentation.**
41. B.-C. Tran Khac, K.-J. Jeon, S.T. Choi, Y.A. Kim, F.W. DelRio, and K.-H. Chung. Laser-induced particle adsorption on atomically thin MoS_2. *ACS Applied Materials and Interfaces* **8**, 2974-2984, 2016.
40. D.-H. Tsai, Y.-F. Lu, F.W. DelRio, T.J. Cho, K.M. Tyner, S. Guha, M.R. Zachariah, F. Zhang, A. Allen, and V.A. Hackley. Orthogonal analysis of functional gold nanoparticles for biomedical applications. *Analytical and Bioanalytical Chemistry* **407**, 8411-8422, 2015. **Paper in forefront.**
39. B.G. Bush, J.M. Shapiro, F.W. DelRio, R.F. Cook, and M.L. Oyen. Mechanical measurements of heterogeneity and length scale effects in PEG-based hydrogels. *Soft Matter* **11**, 7191-7200, 2015.
38. M.J. McLean, W.A. Osborn, R. Kirkpatrick, O. Boomhower, C. Keimel, and F.W. DelRio. Micromechanical testing of electroplated gold alloy films using theta-like specimens. *MRS Communications* **5**, 503-506, 2015.
37. F.W. DelRio, R.F. Cook, and B.L. Boyce. Fracture strength of micro- and nano-scale silicon components. *Applied Physics Reviews* **2**, 021303, 2015. **Invited review paper. Editor's picks of 2015.**

36. S.S. Hazra, J.L. Beuth, G.A. Myers, F.W. DelRio, and M.P. de Boer. Design and test of reliable high strength ingressive polycrystalline silicon microgripper arrays. *Journal of Micromechanics and Microengineering* **25**, 015009, 2015.
35. G.A. Myers, S.S. Hazra, M.P. de Boer, C.A. Michaels, S.J. Stranick, R.P. Koseski, R.F. Cook, and F.W. DelRio. Stress mapping of micromachined polycrystalline silicon devices via confocal Raman microscopy. *Applied Physics Letters* **104**, 191908, 2014.
34. D.-H. Tsai, T.J. Cho, F.W. DelRio, J.M. Gorman, J. Zheng, J. Tan, M.R. Zachariah, and V.A. Hackley. Controlled formation and characterization of dithiothreitol-conjugated gold nanoparticle clusters. *Langmuir* **30**, 3397-3405, 2014.
33. K.-H. Chung, A.K. Chen, C.R. Anderton, K. Bhadriraju, A.L. Plant, B.G. Bush, R.F. Cook, and F.W. DelRio. Frictional properties of native and functionalized type I collagen thin films. *Applied Physics Letters* **103**, 143703, 2013.
32. F.W. DelRio, L.H. Friedman, M.S. Gaither, W.A. Osborn, and R.F. Cook. Decoupling small-scale roughness and long-range features on deep reactive ion etched silicon surfaces. *Journal of Applied Physics* **114**, 113506, 2013.
31. D.-H. Tsai, F.W. DelRio, J. Pettibone, P.-A. Lin, R. Sharma, J. Tan, M.R. Zachariah, and V.A. Hackley. Temperature-programmed electrospray-differential mobility analysis for characterization of ligated nanoparticles in complex media. *Langmuir* **29**, 11267-11274, 2013.
30. A.K. Chen, F.W. DelRio, A.W. Peterson, K.-H. Chung, K. Bhadriraju, and A.L. Plant. Cell spreading and proliferation in response to the composition and mechanics of engineered fibrillar extracellular matrices. *Biotechnology and Bioengineering* **110**, 2731-2741, 2013.
29. R. Kirkpatrick, W.A. Osborn, M.S. Gaither, R.S. Gates, F.W. DelRio, and R.F. Cook. On the bending strength of single-crystal silicon theta-like specimens. *MRS Communications* **3**, 113-117, 2013.
28. M.S. Gaither, R.S. Gates, R. Kirkpatrick, R.F. Cook, and F.W. DelRio. Etching process effects on surface structure, fracture strength, and reliability of single-crystal silicon theta-like specimens. *Journal of Microelectromechanical Systems* **22**, 589-602, 2013.
27. B.G. Bush, F.W. DelRio, C. Jaye, D.A. Fischer, and R.F. Cook. Interfacial mechanical properties of *n*-alkylsilane monolayers on silicon substrates. *Journal of Microelectromechanical Systems* **22**, 34-43, 2013.
26. C.R. Anderton, F.W. DelRio, K. Bhadriraju, and A.L. Plant. The effect of high vacuum on the mechanical properties and bioactivity of collagen fibril matrices. *Biointerphases* **8**, 2, 2013. **Research highlight paper.**
25. D.-H. Tsai, M.P. Shelton, F.W. DelRio, S. Elzey, S. Guha, M.R. Zachariah, and V.A. Hackley. Quantifying dithiothreitol displacement of functional ligands from gold nanoparticles. *Analytical and Bioanalytical Chemistry* **404**, 3015-3023, 2012.
24. D.-H. Tsai, S. Elzey, F.W. DelRio, A.M. Keene, K.M. Tyner, J.D. Clogston, R.I. MacCuspie, S. Guha, M.R. Zachariah, and V.A. Hackley. Tumor necrosis factor interaction with gold nanoparticles. *Nanoscale* **4**, 3208-3217, 2012.
23. G. Stan, F.W. DelRio, R.I. MacCuspie, and R.F. Cook. Nanomechanical properties of polyethylene glycol brushes on gold substrates. *Journal of Physical Chemistry B* **116**, 3138-3147, 2012.
22. M.S. Gaither, F.W. DelRio, R.S. Gates, and R.F. Cook. Deformation and fracture of single-crystal silicon theta-like specimens. *Journal of Materials Research* **26**, 2575-2589, 2011. **Invited feature paper.**
21. R.P. Koseski, W.A. Osborn, S.J. Stranick, F.W. DelRio, M.D. Vaudin, T. Dao, V.H. Adams, and R.F. Cook. Micro-scale measurement and modeling of stress in silicon surrounding a tungsten-filled through-silicon via. *Journal of Applied Physics* **110**, 073517, 2011.
20. F.W. DelRio, D.M. Rampulla, C. Jaye, G. Stan, R.S. Gates, D.A. Fischer, and R.F. Cook. Structure-property relationships for methyl-terminated alkyl self-assembled monolayers. *Chemical Physics Letters* **512**, 243-246, 2011.
19. D.-H. Tsai, M. Davilla-Morris, F.W. DelRio, S. Guha, M.R. Zachariah, and V.A. Hackley. Quantitative determination of competitive molecular adsorption on gold nanoparticles using attenuated total reflectance-Fourier transform infrared spectroscopy. *Langmuir* **27**, 9302-9313, 2011.
18. D.-H. Tsai, T.J. Cho, F.W. DelRio, J. Taurozzi, M.R. Zachariah, and V.A. Hackley. Hydrodynamic fractionation of finite size gold nanoparticle clusters. *Journal of the American Chemical Society* **133**, 8884-8887, 2011.

17. D.-H. Tsai, F.W. DelRio, A.M. Keene, K.M. Tyner, R.I. MacCuspie, T.J. Cho, M.R. Zachariah, and V.A. Hackley. Adsorption and conformation of serum albumin protein on gold nanoparticles investigated using dimensional measurements and in situ spectroscopic methods. *Langmuir* **27**, 2464-2477, 2011.
16. D.-H. Tsai, F.W. DelRio, R.I. MacCuspie, T.J. Cho, M.R. Zachariah, and V.A. Hackley. Competitive adsorption of thiolated polyethylene glycol and mercaptopropionic acid on gold nanoparticles measured by physical characterization methods. *Langmuir* **26**, 10325-10333, 2010.
15. M.S. Gaither, F.W. DelRio, R.S. Gates, E.R. Fuller, and R.F. Cook. Strength distribution of single-crystal silicon theta-like specimens. *Scripta Materialia* **63**, 422-425, 2010.
14. F.W. DelRio, K.L. Steffens, C. Jaye, D.A. Fischer, and R.F. Cook. Elastic, adhesive, and charge transport properties of a metal-molecule-metal junction: the role of molecular orientation, order, and coverage. *Langmuir* **26**, 1688-1699, 2010.
13. F.W. DelRio, C. Jaye, D.A. Fischer, and R.F. Cook. Elastic and adhesive properties of alkanethiol self-assembled monolayers on gold. *Applied Physics Letters* **94**, 131909, 2009.
12. D.-I. Kim, N. Pradeep, F.W. DelRio, and R.F. Cook. Mechanical and electrical coupling at metal-insulator-metal nano-scale contacts. *Applied Physics Letters* **93**, 203102, 2008. **Selected for publication in the *Virtual Journal of Nanoscale Science and Technology* 18, 2008.**
11. F.W. DelRio, M.L. Dunn, and M.P. de Boer. Capillary adhesion model for contacting micromachined surfaces. *Scripta Materialia* **59**, 916-920, 2008. **Viewpoint paper.**
10. M.P. de Boer, F.W. DelRio, and M.S. Baker. On-chip test structure suite for free-standing metal film mechanical property testing, Part I - Analysis. *Acta Materialia* **56**, 3344-3352, 2008.
9. M. Hon, F.W. DelRio, J.T. White, M. Kendig, C. Carraro, and R. Maboudian. Cathodic corrosion of polycrystalline silicon MEMS. *Sensors and Actuators A: Physical* **145-146**, 323-329, 2008.
8. B. Bush, F.W. DelRio, J. Opatkiewicz, R. Maboudian, and C. Carraro. Effect of formation temperature and roughness on surface potential of octadecyltrichlorosilane self-assembled monolayer on silicon surfaces. *Journal of Physical Chemistry A* **111**, 12339-12343, 2007.
7. F.W. DelRio, J. Lai, N. Ferralis, T.-J. King Liu, and R. Maboudian. Al-2%Si induced crystallization of amorphous silicon. *Electrochemical and Solid-State Letters* **10**, H337-H339, 2007.
6. F.W. DelRio, M. L. Dunn, L.M. Phinney, C.J. Bourdon, and M.P. de Boer. Rough surface adhesion in the presence of capillary condensation. *Applied Physics Letters* **90**, 163104, 2007.
5. C.F. Herrmann, F.W. DelRio, D.C. Miller, S.M. George, V.M. Bright, J.L. Ebel, R.E. Strawser, R. Cortez, and K.D. Leedy. Alternative dielectric films for RF MEMS capacitive switches deposited using atomic layer deposited Al_2O_3/ZnO alloys. *Sensors and Actuators A: Physical* **135**, 262-272, 2007.
4. F.W. DelRio, M.L. Dunn, and M.P. de Boer. Growth of silicon carbide nanoparticles using tetraethylorthosilicate for microelectromechanical systems. *Electrochemical and Solid-State Letters* **10**, H27-H30, 2007.
3. F.W. DelRio, M.L. Dunn, B.L. Boyce, A.D. Corwin, and M.P. de Boer. The effect of nanoparticles on rough surface adhesion. *Journal of Applied Physics* **99,** 104304, 2006.
2. F.W. DelRio, M.P. de Boer, J.A. Knapp, E.D. Reedy, P.J. Clews, and M.L. Dunn. The role of van der Waals forces in adhesion of micromachined surfaces. *Nature Materials* **4,** 629-634, 2005.
1. C.F. Herrmann, F.W. DelRio, V.M. Bright, and S.M. George. Conformal hydrophobic coatings prepared using atomic layer deposition seed layers and non-chlorinated hydrophobic precursors. *Journal of Micromechanics and Microengineering* **15,** 984-992, 2005.

PATENTS AND INVENTION DISCLOSURES

1. R. Maboudian, F.W. DelRio, J. Lai, and T.-J. King Liu. Low-temperature formation of polycrystalline semiconductor films via enhanced metal-induced crystallization. U.S. patent number 8,043,943. 2011.

STANDARD GUIDES AND TEST METHODS

2. Standard guide for size measurement of nanoparticles using atomic force microscopy. American Society for Testing and Materials, Committee E56 on Nanotechnology, E56.02 on Characterization: Physical, Chemical and Toxicological Properties. Standard guide number E2859-11, 2011.
1. Test method for wafer bond strength measurements using micro-chevron test structures. SEMI Standards Program, MEMS/NEMS Technical Committee. Test method number MS5-1107, 2007.

CONFERENCE PROCEEDINGS

14. F.W. DelRio, B.-C. Tran Khac, and K.-H. Chung. Friction and fracture of 2D materials. *NanoOstrava*, Ostrava, Czech Republic, May 13-16, 74-76, 2019.
13. S. Berweger, P.T. Blanchard, R.C. Quardokus, F.W. DelRio, T.M. Wallis, P. Kabos, S. Krylyuk, and A. Davydov. Near-field microwave microscopy of one-dimensional nanostructures. *IEEE MTT-S International Microwave Symposium (IMS2016)*, San Francisco, CA, May 22-27, 2016.
12. F.W. DelRio, G.A. Myers, S.S. Hazra, M.P. de Boer, C.A. Michaels, S.J. Stranick, and R.F. Cook. Stress mapping of polycrystalline silicon devices via confocal Raman microscopy. *Society of Experimental Mechanics Annual Conference and Exposition*, Costa Mesa, CA, June 8-11, 2015.
11. S. Grutzik, B.G. Bush, F.W. DelRio, R.S. Gates, M.A. Hines, and A. Zehnder. Effect of organic SAMs on the evolution of strength of silicon nanostructures. *Society of Experimental Mechanics Annual Conference and Exposition*, Lombard, IL, June 3-5, 2013.
10. F.W. DelRio, B.G. Bush, M.S. Gaither, and R.F. Cook. Nanomechanical properties of silicon and its interfaces. *The Adhesion Society Annual Meeting and Exposition*, Daytona Beach, FL, March 3-6, 2013.
9. F.W. DelRio, C. Jaye, D.A. Fischer, and R.F. Cook. Elastic, adhesive, and charge transport properties of methyl-terminated alkylthiol self-assembled monolayers on gold surfaces. *The Adhesion Society Annual Meeting and Exposition*, New Orleans, LA, February 26-29, AS065, 2012.
8. M.D. Vaudin, G. Stan, F.W. DelRio, L.H. Friedman, and R.F. Cook. EBSD Strain Analysis of Epitaxial $Si_{1-x}Ge_x$ on Si. *Microscopy and Microanalysis*, Nashville, TN, August 7-11, 422-423, 2011.
7. M.S. Gaither, F.W. DelRio, R.S. Gates, E.R. Fuller, and R.F. Cook. Theta-like specimen to determine tensile strength at the micro-scale. *23rd IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2010)*, Hong Kong, January 24-28, 540-543, 2010.
6. R.A. Allen, J.C. Marshall, W.A. Baylies, D.T. Read, F.W. DelRio, K.T. Turner, M. Bernasch, and J. Bagdahn. A standard method for measuring wafer bond strength for MEMS applications. *Pacific Rim Meeting on Electrochemical and Solid-State Science*, Honolulu, HI, October 12-17, 449-455, 2008.
5. M. Hon, F. W. DelRio, C. Carraro, and R. Maboudian. Effects of relative humidity and actuation voltage on MEMS reliability. *The 14th International Conference on Solid-State Sensors, Actuators, and Microsystems*, Lyon, France, June 10-14, 367-370, 2007.
4. F.W. DelRio, M. L. Dunn, L.M. Phinney, C.J. Bourdon, and M.P. de Boer. Van der Waals and capillary adhesion of microelectromechanical systems. *ASME International Mechanical Engineering Congress and Exposition*, Chicago, IL, November 5-10, IMECE2006-15169, 2006.
3. C.F. Herrmann, F.W. DelRio, S.M. George, and V.M. Bright. Properties of atomic layer deposited Al_2O_3/ZnO dielectric films grown at low temperature for RF MEMS. *Proceedings of SPIE* **5715,** 159-166, 2005.
2. F.W. DelRio, C.F. Herrmann, N. Hoivik, S.M. George, V.M. Bright, J.L. Ebel, R.E. Strawser, R. Cortez, and K.D. Leedy. Atomic layer deposition of Al_2O_3/ZnO nano-scale films for gold RF MEMS. *IEEE MTT-S International Microwave Symposium (IMS2004)*, Fort Worth, TX, June 6-11, 1923-1926, 2004.
1. C.F. Herrmann, F.W. DelRio, V.M. Bright, and S.M. George. Hydrophobic coatings using atomic layer deposition and non-chlorinated precursors. *17th IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2004)*, Maastricht, Netherlands, January 25-29, 653-656, 2004.

CONFERENCE AND WORKSHOP PRESENTATIONS

38. F.W. DelRio, R.F. Cook, and B.L. Boyce. Size and spatial density attributes of material flaw populations in polysilicon MEMS structures. *ASME International Mechanical Engineering Congress and Exposition*, Salt Lake City, UT, November 11-14, 2019.
37. F.W. DelRio, J.T. Benzing, L.-A. Liew, and N.W. Hrabe. Mesoscale tensile testing of additively-manufactured Ti-6Al-4V to track the evolution of porosity and microstructural heterogeneities. *ASME International Mechanical Engineering Congress and Exposition*, Salt Lake City, UT, November 11-14, 2019.
36. F.W. DelRio, R.F. Cook, and B.L. Boyce. Strength distributions and flaw populations of multi-layer polycrystalline silicon MEMS structures. *SEM Annual Conference and Exposition on Experimental and Applied Mechanics*, Reno, NV, June 3-6, 2019.
35. F.W. DelRio, B.-C. Tran Khac, and K.-H. Chung. Friction and fracture of 2D materials. *NanoOstrava*, Ostrava, Czech Republic, May 13-16, 2019. **Invited presentation.**

34. F.W. DelRio. In-situ and high-throughput stress and strength measurements of small-scale silicon devices. *National Academies German-American Frontiers of Engineering Symposium*, Hamburg, Germany, March 21-23, 2019. **Invited presentation.**
33. F.W. DelRio, B.-C. Tran Khac, Hyun-Joon Kim, and K.-H. Chung. Mechanics of adhesion and friction in 2D materials. *ASME International Mechanical Engineering Congress and Exposition*, Pittsburgh, PA, November 9-15, 2018. **Invited presentation.**
32. F.W. DelRio, B.-C. Tran Khac, and K.-H. Chung. Interfacial strength and surface damage characteristics of two-dimensional h-BN, MoS_2 and graphene. *AVS 65th International Symposium and Exhibition*, Long Beach, CA, October 21-26, 2018.
31. F.W. DelRio, R.F. Cook, and B.L. Boyce. Applicability of Weibull statistics for micro- and nano-scale silicon components. *TMS Annual Meeting and Exhibition*, Phoenix, AZ, March 11-15, 2018. **Invited presentation.**
30. F.W. DelRio, R.F. Cook, and B.L. Boyce. 'Silicon as a mechanical material': revisiting a seminal paper in MEMS and NEMS. *Embassy Science Fellowship*, Czech Republic and Germany, May 15-June 14, 2017. **Invited presentation.**
29. F.W. DelRio, B.G. Bush, R.F. Cook, J.M. Shapiro, and M.L. Oyen. Heterogeneity and length scale effects in PEG-based hydrogels. *SEM Annual Conference and Exposition on Experimental and Applied Mechanics*, Orlando, FL, June 6-9, 2016.
28. F.W. DelRio, R.M. White, S. Krylyuk, A.V. Davydov, L.H. Friedman, and R.F. Cook. Near-theoretical fracture strengths in native and oxidized silicon nanowires. *SEM Annual Conference and Exposition on Experimental and Applied Mechanics*, Orlando, FL, June 6-9, 2016.
27. F.W. DelRio. Nanomechanics of advanced materials for next-generation biomaterials and electronics. *National Academies Arab-American Frontiers of Science, Engineering, and Medicine Symposium*, Thuwal, Saudi Arabia, December 5-7, 2015. **Invited presentation.**
26. F.W. DelRio, G. Stan, B.G. Bush, J.M. Shapiro, R.F. Cook, and M.L. Oyen. Mechanics of PEG-based films and hydrogels. *International Scanning Probe Microscopy Conference*, Búzios, Brazil, June 21-24, 2015. **Invited presentation.**
25. F.W. DelRio. Mechanics of hydrated materials for biomedical and health applications. *International Scanning Probe Microscopy Hands-On Workshop*, Rio de Janeiro, Brazil, June 18-20, 2015. **Invited presentation.**
24. F.W. DelRio, G.A. Myers, S.S. Hazra, M.P. de Boer, C.A. Michaels, S.J. Stranick, and R.F. Cook. Stress mapping of polycrystalline silicon devices via confocal Raman microscopy. *SEM Annual Conference and Exposition on Experimental and Applied Mechanics*, Costa Mesa, CA, June 8-11, 2015.
23. F.W. DelRio, B.G. Bush, M.S. Gaither, and R.F. Cook. Fracture strength of micro- and nano-scale silicon components. *ASME International Mechanical Engineering Congress and Exposition*, Montreal, Canada, November 14-20, 2014. **Invited presentation.**
22. F.W. DelRio, R.F. Cook, B.G. Bush, A.K. Chen, C.R. Anderton, K. Bhadriraju, A.L. Plant, and K.-H. Chung. Frictional properties of native and functionalized type I collagen thin films. *ASME International Mechanical Engineering Congress and Exposition*, Montreal, Canada, November 14-20, 2014.
21. F.W. DelRio, B.G. Bush, M.S. Gaither, and R.F. Cook. Nanoscale strength of silicon and its interfaces. *TMS Materials Science & Technology*, Pittsburgh, PA, October 12-16, 2014. **Invited presentation.**
20. F.W. DelRio. From Si microdevices to PEG nanocoatings: exploring advanced materials via nanomechanics. *National Academies Brazil-U.S. Frontiers of Sciences and Engineering Symposium*, Rio de Janeiro, Brazil, March 17-19, 2014. **Invited presentation.**
19. F.W. DelRio, L.H. Friedman, M.S. Gaither, W.A. Osborn, and R.F. Cook. Roughness scaling and fracture strength of deep reactive ion etched silicon surfaces. *Materials Research Society Fall Meeting*, Boston, MA, December 1-6, 2013.
18. F.W. DelRio, R. Kirkpatrick, W.A. Osborn, M.S. Gaither, R.S. Gates, and R.F. Cook. Tensile and bending strength of single-crystal silicon theta specimens. *ASME International Mechanical Engineering Congress and Exposition*, San Diego, CA, November 15-21, 2013.
17. F.W. DelRio, B.G. Bush, M.S. Gaither, and R.F. Cook. Nanomechanical properties of silicon and its interfaces. *The Adhesion Society Annual Meeting and Exposition*, Daytona Beach, FL, March 3-6, 2013.
16. F.W. DelRio, B.G. Bush, M.S. Gaither, and R.F. Cook. Measuring the nanomechanical properties of molecular coatings and their underlying substrates. *The Adhesive and Sealant Council Fall Convention*, Louisville, KY, October 21-23, 2012. **Invited presentation.**

15. F.W. DelRio, B.G. Bush, M.S. Gaither, and R.F. Cook. Nanoscale strength of silicon and its interfaces. *Solid-State Sensors, Actuators, and Microsystems Workshop*, Hilton Head, SC, June 3-7, 2012.
14. F.W. DelRio, G. Stan, R.I. MacCuspie, and R.F. Cook. Nanomechanical properties of polyethylene glycol coatings on flat gold substrates. *TMS Annual Meeting and Exhibition*, Orlando, FL, March 11-15, 2012.
13. F.W. DelRio, C. Jaye, D.A. Fischer, and R.F. Cook. Elastic, adhesive, and charge transport properties of methyl-terminated alkylthiol self-assembled monolayers on gold surfaces. *The Adhesion Society Annual Meeting and Exposition*, New Orleans, LA, February 26-29, 2012.
12. F.W. DelRio, M.S. Gaither, R.S. Gates, E.R. Fuller, and R.F. Cook. Theta-like specimen to determine tensile strength at the micro-scale. *23rd IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2010)*, Hong Kong, January 24-28, 2010.
11. F.W. DelRio. Using fracture mechanics to improve MEMS reliability. *ASME International Mechanical Engineering Congress and Exposition*, Orlando, FL, November 13-19, 2009. **Invited presentation.**
10. F.W. DelRio, C. Jaye, D.A. Fischer, and R.F. Cook. Mechanical and electrical properties of alkanethiol self-assembled monolayers on gold. *Materials Research Society Spring Meeting*, San Francisco, CA, April 13-17, 2009.
9. F.W. DelRio, D.-I. Kim, N. Pradeep, and R.F. Cook. Mechanical and electrical coupling at nanoscale metallic contacts. *Gordon Research Conference: Thin Film and Small Scale Mechanical Behavior*, Waterville, ME, July 27-August 1, 2008.
8. F.W. DelRio, J. Lai, T.-J. King Liu, and R. Maboudian. Low-temperature formation of polycrystalline silicon thin films via enhanced aluminum-induced crystallization. *AVS 54th International Symposium & Exhibition*, Seattle, WA, October 14-19, 2007.
7. F.W. DelRio, M. L. Dunn, L.M. Phinney, C.J. Bourdon, and M.P. de Boer. Van der Waals and capillary adhesion of microelectromechanical systems. *ASME International Mechanical Engineering Congress and Exposition*, Chicago, IL, November 5-10, 2006.
6. F.W. DelRio, M.L. Dunn, B.L. Boyce, A.D. Corwin, and M.P. de Boer. The effect of nanoparticles on MEMS adhesion. *University of Colorado Graduate Engineering Annual Research Symposium (GEARS)*, Boulder, CO, March 9, 2006.
5. F.W. DelRio, M.P. de Boer, B.L. Boyce, and M.L. Dunn. The effect of nanoparticles on MEMS adhesion. *Materials Research Society Fall Meeting*, Boston, MA, November 28 - December 2, 2005.
4. F.W. DelRio, M.L. Dunn, B.L. Boyce, A.D. Corwin, and M.P. de Boer. Mechanical and tribological properties of nanoparticles on micromachined surfaces. *Sandia National Laboratories Student Internship Program Symposium*, Albuquerque, NM, August 2, 2015.
3. F.W. DelRio, M.P. de Boer, J.A. Knapp, P.J. Clews, and M.L. Dunn. Role of van der Waals forces in adhesion of micromachined surfaces. *Materials Research Society Fall Meeting*, Boston, MA, November 29 - December 3, 2004. **Best poster award.**
2. F.W. DelRio, C.F. Herrmann, N. Hoivik, S.M. George, V.M. Bright, J.L. Ebel, R.E. Strawser, R. Cortez, and K.D. Leedy. Atomic layer deposition of Al_2O_3/ZnO nano-scale films for gold RF MEMS. *IEEE MTT-S International Microwave Symposium (IMS2004)*, Fort Worth, TX, June 6-11, 2004.
1. F.W. DelRio, C.F. Herrmann, N. Hoivik, S.M. George, V.M. Bright, J.L. Ebel, R.E. Strawser, R. Cortez, and K.D. Leedy. Atomic layer deposition of Al_2O_3/ZnO nano-scale films for gold RF MEMS. *University of Colorado Graduate Engineering Annual Research Symposium (GEARS)*, Boulder, CO, April 20, 2004.

PROFESSIONAL SERVICE

Society Leadership Positions

Vice-Chair, MEMS and Nanotechnology Technical Division, SEM, 2019-Present
Secretary, MEMS and Nanotechnology Technical Division, SEM, 2017-2019
Secretary, Executive Committee, ASME-Colorado Section, 2015-2016
Chair, Electronics Materials Technical Committee, Materials Division, ASME, 2014-2016
Chair, Experimental Mechanics Technical Committee, Applied Mechanics Division, ASME, 2013-2015
President-Elect, NIST Sigma Xi Chapter, 2013-2014
Director, Executive Committee, ASME-DC Section, 2013-2014
Secretary, Experimental Mechanics Technical Committee, Applied Mechanics Division, ASME, 2011-2013

Conference Leadership Positions
Symposium Organizer, Micro- and Nanomechanics, SEM Annual Conference and Exposition, 2020
Symposium Organizer, Micro- and Nanomechanics, SEM Annual Conference and Exposition, 2019
Conference Organizer, Structural Reliability Partnership Workshop, 2018
Symposium Organizer, Micro- and Nanomechanics, SEM Annual Conference and Exposition, 2018
Conference Organizer, US-Czech Conference on Advanced Nanotechnology and Chemistry, 2018
Topic Organizer, Mechanics of Adhesion and Friction, ASME IMECE, 2017
Session Organizer, 1D and 2D Materials and Fabrication, SEM Annual Conference and Exposition, 2017
Conference Organizer, Federal Interagency Materials Representatives Meeting, 2017
Topic Organizer, Mechanics of Adhesion and Friction, ASME IMECE, 2016
Topic Organizer, Electronics in Extreme/Harsh Environments, ASME IMECE, 2016
Topic Organizer, Mechanics of Adhesion and Friction, ASME IMECE, 2015
Session Organizer, Electronic Packaging, SEM Annual Conference and Exposition, 2015
Topic Organizer, Mechanics of Adhesion and Friction, ASME IMECE, 2014
Symposium Organizer, Microelectromechanical Systems − Materials and Devices VI, MRS Fall, 2013
Topic Organizer, Mechanics of Adhesion and Friction, ASME IMECE, 2013
Session Organizer, Micro- and Nanoscale Adhesion, The Adhesion Society Annual Meeting, 2013
Topic Organizer, Tribology of Thin Films and Small-Scale Structures, ASME IMECE, 2012
Topic Organizer, Quality and Reliability in Electronics, Photonics, MEMS and NEMS, ASME IMECE, 2012
Symposium Organizer, Microelectromechanical Systems − Materials and Devices V, MRS Fall, 2011
Topic Organizer, Constitutive/Failure Response of Thin Films/Multilayered Structures, ASME IMECE, 2011
Symposium Organizer, Microelectromechanical Systems − Materials and Devices IV, MRS Fall, 2010
Topic Organizer, Mechanics of Thin Films and Small-Scale Structures, ASME IMECE, 2010
Symposium Assistant, Impact-Blast Mechanics, USNCTAM, 2006
Symposium Assistant, Vortex Dynamics, USNCTAM, 2006
Symposium Assistant, Poromechanics, USNCTAM, 2006
Symposium Assistant, Bifurfaction/Instability of Geological and Granular Materials, USNCTAM, 2006
Symposium Assistant, Innovations for Sub-100 nm Lithography, MRS, 2004
Symposium Assistant, Bio-Inspired and Bio-Derived Materials and Processes, MRS, 2004

Journal Leadership Positions
Editorial Board, Experimental Mechanics, Springer, 2020-Present
Editorial Board, Journal of Micromechanics and Microengineering, Institute of Physics, 2019-Present
Editorial Board, Nano Futures, Institute of Physics, 2016-Present
Editorial Board, Nanotechnology, Institute of Physics, 2016-Present
Editorial Board, Materials Research Express, Institute of Physics, 2013-2018
Editorial Board, MRS Proceedings (MRS Advances), Materials Research Society, 2012-2016

Book Leadership Positions
Guest Editor, Micro- and Nanoscale Systems – Novel Materials, Structures and Devices, MRS Proceedings, 2014
Guest Editor, MEMS, BioMEMS, and Bioelectronics – Materials and Devices, MRS Proceedings, 2012
Guest Editor, Microelectromechanical Systems – Materials and Devices IV, MRS Proceedings, 2011

NIST Leadership Positions
Member, NIST Infrastructure Working Group, 2019-Present
Member, MML Awards Committee, 2018-Present
Member, MML People Council, 2015-2019
Member, Gebbie Lab Operations Group, 2015-2017
Member, MML Accolades Committee, 2015-2017

University Leadership Positions
Industry Advisory Board, Mechanical and Materials Engineering, University of Denver, 2018-Present
Adjunct Professor, Mechanical Engineering, University of Colorado Denver, 2018-Present