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EDUCATION

- Ph.D. 5/2002 Major: *Mechanical Engineering*, Minor: *Electrical Engineering*, North Carolina State University, Raleigh, North Carolina.
- M.S. 8/1999 *Mechanical Engineering*, Iowa State University, Ames, Iowa.
- M.E. 3/1998 *Precision Instrument Engineering*, Tianjin University, China.
- B.S. 7/1995 *Precision Instrument Engineering*, Tianjin University, China.

EXPERIENCE

- 1/2016 – present *Distinguished R&D Staff Scientist*, Materials Science & Technology Division, ORNL
- 10/2011 – 12/2015 *Senior R&D Staff Scientist*, Materials Science & Technology Division, ORNL
- 1/2007 – 9/2011 *R&D Staff Scientist,* Materials Science & Technology Division, ORNL
- 2/2004 – 12/2006 *Junior R&D Staff Scientist*, Metals & Ceramics Division, ORNL
- 5/2002 – 2/2004 *Postdoctoral Research Associate*, Metals & Ceramics Division, ORNL

RESEARCH INTERESTS

- Goals: To investigate and address tribological issues in automotive (including electric vehicle), hydraulics, nuclear reactor, and renewable energies (e.g., biomass preprocessing and wind turbine)
- Approaches
  - Energy-efficient and eco-friendly lubricants with ionic and nano additives
  - Wear/corrosion-resistant surface engineering, coatings, and nanostructured materials
  - Additive manufacturing of tribological materials
  - Understand tribochemical interactions at the contact interface

HONORS

- **Fellow**, *Society of Tribologists & Lubrication Engineers (STLE)*, 2017.
- **Invited attendee to U.S. Frontiers of Engineering Symposium**, *National Academy of Engineering (NAE)*, 2015.
- **R&D 100 Award** (as Team Lead), jointly among ORNL, GM, Shell, and Lubrizol, Ionic liquid anti-wear additives for fuel-efficient engine lubricants, *R&D Magazine*, 2014.
- **U.S. DOE Vehicle Technologies Office R&D Award**, Development of novel ionic liquid engine oil additives with the potential to deliver a 2-percent fuel economy improvement, *U.S. Department of Energy*, 2014.
- **John Bollinger Outstanding Young Manufacturing Engineer Award**, Conferred in recognition of significant achievement and leadership in manufacturing engineering, *Society of Manufacturing Engineers (SME)*, 2009.
- ORNL Significant Event Award, Discovery and fundamental understanding of incompatibility between diamond-like-carbon coatings and lubricant additives provide new insights for future materials development, 2015.
- ORNL Significant Event Award, Development of lubricant that meets DOE goal of 2 percent vehicle fuel economy improvement, 2014.

- ORNL Significant Event Award, Breakthrough in ionic liquid lubricants recognized by a major DOE program award, 2011.
- ORNL Supplemental Performance Award*,* 2012, 2013, 2014, 2015, 2016, 2017, 2018.

MEDIA REPORTS

1. "ORNL, Shell develop a less friction/wear hybrid lubricant additive," *World Industrial Reporter*, Sept. 2, 2015.
2. "Reduce wear with synergistic lubricant pair," *Materials Views*, July 28, 2015.
3. "Low-friction engine oil," *R&D Magazine*, August 19, 2014.
4. "National lab: New oil additive saves 2% on gas," *USA Today,* July 28, 2014
5. "Lab rolls out ideas for future vehicles," *Detroit Free Press,* July 27, 2014
6. "Oak Ridge-GM prototype low-viscosity ionic liquid-additized engine oil delivers 2% fuel economy improvement over 5W-30," *Green Car Congress*, Dec. 30, 2013
7. "Molten salts could improve fuel economy," *Inside Science News*, Nov. 15, 2013
8. "Lubricating titanium," *Tribology & Lubrication Technology,* Nov. 2012
9. "Unleashing the potential of ionic liquids," *Tribology & Lubrication Technology,* Apr. 2010.
10. "Nanocoatings boost industrial energy efficiency," *Science Daily*, Nov. 2008
11. "Supersaturated steel could save energy in factories," *Science Daily*, Aug. 2007.

AFFILIATIONS AND PROFESSIONAL ACTIVITIES

- Fellow, *Society of Tribologists & Lubrication Engineers* (STLE), 2017-present.
- Committee Member, U.S. DOE Lubricant Working Group, 2015-present.
- Director and Steering Committee Member, *Wear of Materials*, 2011-present.
- Emerging Professional and Committee Member, *ASTM International, G2 on Wear and Erosion and D02 on Petroleum Products, Liquid Fuels, and Lubricants*, 2017-present.
- Associate Editor, *Lubricants*, 2017-present. Editor for Special Issue "*Advanced Lubrication for Energy Efficiency*," 2017-2018.
- Associate Editor, *Frontiers in Mechanical Engineering*, 2015-present. Editor for Special Issue "*Advanced Tribology and Lubrication: From Nanoscale Phenomena to Real World Applications*," 2018-2019.
- Associate Editor, *17th, 21st and 22nd International Conference on Wear of Materials*, 2009, 2017, 2019.
- Key Reader, *Metallurgical and Materials Transactions A*, 2013-present.
- Technical Editor, *Tribology & Lubrication Technology*, 2009-2014.
- Chair, Technical Committee of Lubrication Fundamentals, *STLE*, 2014-2016.
- Chair, Technical Committee of Surface Engineering, *STLE*, 2008-2009.
- Organizer, Sessions of Lubrication Fundamentals, *2014 STLE Annual Meeting*.
- Organizer, Symposium for Hardfacing Coatings for Wear and Corrosion Resistance Applications, *Materials Science & Technology (MS&T) 2010 and 2012 Conferences*.
- Organizer, Sessions of Surface Engineering, *2008 STLE Annual Meeting*.

SELECTED RESEARCH PROJECTS (*35 grants of >$26M, lead-PI for 25 grants of >$15M, on-going and new projects in* ***bold*** *fonts*)

- *Advanced lubrication for automotive*

1. **Ionic liquids as novel lubricant additives for automotive applications** (PI, ORNL Seed 2005-06; DOE CRADA w/ GM 2009-13; DOE FOA award CRADA w/ Shell 2012-15; **DOE VTO FOA award w/ GM 2015-19**)
2. **Environmentally friendly, high performance hydraulic fluids (PI, DOE VTO LabCall Award 2018-20)**

3. **Organic-modified nanoparticles and metal-complexes as additives for low-viscosity lubricants (PI, Hyundai 2018-20)**
4. Compatibility of between non-ferrous alloys/coatings and lubricant additives (PI, DOE VTO 2013-18)
5. Investigation of the wear mechanism of sooted engine oils (PI, DOE w/ Cummins 2016-18)
6. Oil-dispersible metallic nanoparticles as lubricant additives (co-PI, DOE VTO FOA award w/ UTK and UCM 2015-17)
7. Nanodiamond as engine oil additives (co-PI, DOE VTO Voucher award w/ Cool-X 2016-17)
8. Hyperbranched polymers for improved viscosity and lubricity (co-PI, DOE VTO FOA award w/ PNNL 2014-16)
9. Effects of engine oil aging on friction and wear behavior (co-PI, DOE VTO 2002-05)
10. Diesel fuel injector lubrication and scuffing in ultra low sulfur fuels (co-PI, DOE VTO 2002-05)

- *Surface engineering for automotive and hydraulics*

1. **CNT-modified oleophilic surfaces for lubricant-starved applications (PI, ORNL Seed 2018-19)**
2. Wear-resistant composite coatings by additive manufacturing (PI, DOD AMRDEC 2017)
3. Advanced heavy-duty diesel engine piston materials and coatings (PI, DOE VTO CRADA w/ Cummins 2015-16)
4. Ionic liquids-induced anti-corrosion conversion coatings for Mg alloys (PI, ORNL Seed 2012-14)
5. Surface texturing for friction and wear reduction (PI, DOE VTO 2014)
6. Nanostructured superhydrophobic coatings for drag reduction and anti-corrosion (PI, DOE ITP FOA award w/ Ross Tech and SIT 2009-12)
7. $AlMgB_{14}$-based nanostructured superhard coatings for hydraulic and tooling systems (co-PI, DOE ITP FOA award CRADA w/ Eaton, Ames Lab, and Greenleaf 2007-10)
8. Surface nanocompositing of Al alloys via friction stir processing (PI, ORNL LDRD 2006-08)
9. Surface engineering of Ti alloys for diesel engine and brake applications (PI, DOE VTO 2004-08)
10. Low-temperature colossal carbon supersaturation for austenitic stainless steels (co-PI, DOE ITP FOA award collaborated w/ Swagelok and CWRU 2005-08)

- *Tribology for nuclear and renewable energy*

1. **Investigation and mitigation of machinery wear in biomass pre-processing (PI, DOE BETO AOP and DFO 2018-21)**
2. **Grid-to-rod fretting of candidate accident-tolerant fuel claddings (PI, DOE NEO FOA 2018-21)**
3. **Development of high-temperature molten salt pump technology for gen3 solar power tower systems (co-PI, DOE SETO FOA, 2018-20)**
4. Grid-to-rod fretting modeling and experimental verification, Consortium for Advanced Simulation of Light Water Reactors (CASL) (PI, DOE NEO 2014-17)
5. Bearing failure analysis for wind turbines (co-PI, 2012-14)

- *Manufacturing and materials processing*

1. **Additive manufacturing for reducing friction and wear of engine components (PI, Ford Alliance award 2018-20)**
2. Ionic liquids-produced high-quality, low-defect TiO_2 nanotube array for Li-ion batteries & photoelectrochemical water splitting (PI, DOE ITP FOA award 2009-11)
3. Self-aligned Cu-Si core-shell nanowire array as a novel anode for Li-ion batteries (PI, ORNL Seed 2010-11)
4. Thermal drilling of Al, Mg, and Ti alloys (co-PI, DOE VTO w/ U Michigan 2005-07)
5. High-speed titanium machining (co-PI, DOE VTO w/ TWS and U Michigan 2004-06)
6. Grindability of ceramics and TiC-Ni_3Al composites (co-PI, DOE VTO w/ LSU 2005)
7. Cylindrical wire electrical discharge machining of metals and MMCs followed by micro-blasting to improve surface integrity (NC State, Ph.D. dissertation 1999-2002)

PATENTS

1. J. Qu, H. Luo, "Ionic liquids containing symmetric quaternary phosphonium cations and phosphorus-containing anions, and their use as lubricant additives," U.S. Patent # 9,957,460, May 1, 2018.
2. J. Qu, H. Luo, "Corrosion prevention of magnesium surfaces via surface conversion treatments using ionic liquids," U.S. Patent #9,435,033, September 6, 2016.
3. C. Higdon, A.A. Elmoursi, J. Goldsmith, B. Cook, P.J. Blau, J. Qu, R. Milner, "Ion beam sputter target and method of manufacture," U.S. Patent #8,821,701, August 13, 2014.
4. J. Qu, H.T. Lin, P.J. Blau, V.K. Sikka, "Titanium aluminide intermetallic alloys with improved wear resistance," U.S. Patent #8,771,439 B2, July 8, 2014.
5. J.A. Ambrose, G. Mackiewicz-Ludtka, V.K. Sikka, J. Qu, "Oven rack having integral lubricious, dry porcelain surface," US Patent #8,739,773 B2, June 3, 2014.
6. J. Qu, S. Dai, and H. Luo, "Method for synthesis of titanium dioxide nanotubes using ionic liquids," U.S. Patent #8,585,886, November 19, 2013.
7. J. Qu, J.J. Truhan, S. Dai, H. Luo, P.J. Blau, "Lubricants or lubricant additives composed of ionic liquids containing ammonium cations," U.S. Patent #7,754,664, July 13, 2010.
   – *The first granted U.S. patent on the topic of ionic liquids lubrication.*
8. J. Qu, W.C. Barnhill, H. Luo, B. Kheireddin, H. Gao, B.L. Papke, "Lubricant Formulations Containing Phosphonium Ionic Liquids," U.S. Patent Application 62/321,881, April 13, 2016.
9. J. Qu, H. Luo, "Ionic Liquids Containing Protic or Symmetric Aprotic Ammonium Cations and Phosphinate Anions as Lubricant Additives," U.S. Patent Application 62/321,877, April 13, 2016.
10. B. Zhao, A.E. Wright, K. Wang, J. Qu, "Oil-Soluble Polymer Brush-Grafted Nanoparticles and Uses Thereof," U.S. Patent Application 62/326,244, April 2, 2016.
11. J. Qu, H. Luo, Y. Zhou, J. Dyck, T. Graham, "Ionic liquids containing quaternary phosphonium cations and carboxylate anions, and their use as lubricant additives," U.S. Patent Application 14/444,029, Jul. 28, 2014.

PUBLICATIONS

Google Scholar citations: 3500+, *h*-index: 33
https://scholar.google.com/citations?user=kC_r23MAAAAJ&hl=en

- **Special Journal Issues Edited**

1. "Advanced Tribology and Lubrication: From Nanoscale Phenomena to Real World Applications," Ed. by J. Qu and A. Martini, *Frontiers in Mechanical Engineering*, 2019.
2. "Advanced Lubrication for Energy Efficiency," Ed. by J. Qu and H. Ghaednia, *Lubricants*, 2018.

- **Book Chapters**

1. J. Qu, Chapter 23 "Diesel Fuel Lubrication and Testing," in: S.C. Tung and G.E. Totten, eds. *Automotive Lubricants and Testing*, Eagan, MN, ASTM International, SAE International, 2012.
2. J. Qu, H.M. Meyer, "X-Ray Photoelectron Spectroscopy," in: *Encyclopedia of Tribology*, Springer, 2013.
3. A.H. Heuer, J. Qu, L. O'Donnell, "Low Temperature Carburization," in: *Encyclopedia of Tribology*, Springer, 2013.

- **ASTM International Standards**

1. ASTM G181, "Standard Test Method for Conducting Friction Tests of Piston Ring and Cylinder Liner Materials Under Lubricated Conditions," *ASTM International*, 03.02 (2004).
2. ASTM G206, "Guide for Measuring the Wear Volumes of Piston Ring Segments Run Against Flat Coupons in Reciprocating Wear Tests," *ASTM International*, 03.02 (2011).

- **Refereed Journal Papers** (*total 98, first or corresponding author* of 64*)

1. J. Qu*, W.C. Barnhill, H. Luo, H.M. Meyer, D.N. Leonard, A.K. Landauer, B. Kheireddin, H. Gao, B.L. Papke, S. Dai, "Synergistic effects between phosphonium-alkylphosphate ionic liquids and ZDDP as lubricant additives," *Advanced Materials* 27 (2015) 4767-4774.
2. C. Kumara, D.N. Leonard, H.M. Meyer, H. Luo, B.L. Armstrong, J. Qu*, "Palladium nanoparticles enabled ultra-thick tribofilm with unique composition," *ACS Applied Materials & Interfaces* 10 (2018) 31804−31812.
3. W. Li, C. Kumara, H.M. Meyer, H. Luo, J. Qu*, "Compatibility between various ionic liquids and an organic friction modifier as lubricant additives," *Langmuir* 34 (2018) 10711–10720.
4. Y. Zhou*, W. Li, B.C. Stump, R.M. Connatser, S. Lazarevic, J. Qu*, "Impact of fuel contents on tribological performance of PAO base oil and ZDDP," *Lubricants* 6 (2018) 79.
5. S. Lazarevic, R. Y. Lu, C. Favede, G. Plint, P. J. Blau, J. Qu*, "Investigating grid-to-rod fretting wear of nuclear fuel claddings using a unique autoclave fretting rig," *Wear* 412–413 (2018) 30–37.
6. B. Seymour, W. Fu, R. Wright, J. Qu*, S. Dai, B. Zhao*, "Improved lubricating performance by combining oil-soluble hairy silica nanoparticles and an ionic liquid as an additive for a synthetic base oil," *ACS Applied Materials & Interfaces* 10 (2018) 15129–15139.
7. B.C. Stump, Y. Zhou, M.B. Viola, H. Xu, R.J. Parten, J. Qu*, "A rolling-sliding bench test for investigating rear axle lubrication," *Tribology International* 121 (2018) 450-459.
8. C. Kumara, H. Luo, D.N. Leonard, H.M. Meyer, J. Qu*, "Organic-modified silver nanoparticles as lubricant additives," *ACS Applied Materials & Interfaces* 9 (2017) 37227–37237.
9. Y. Zhou*, D.N. Leonard, W. Guo, J. Qu*, "Understanding tribofilm formation mechanisms in ionic liquid lubrication," *Scientific Reports* 7 (2017) 8426.
10. B. Seymour, R. Wright, A. Parrott, H. Gao, A. Martini, J. Qu*, S. Dai, B. Zhao*, "Poly(alkyl methacrylate) brush-grafted silica nanoparticles as oil lubricant additives: effects of alkyl pendant group on oil dispersibility, stability, and lubrication property," *ACS Applied Materials & Interfaces* 9 (2017) 25038−25048.
11. W. Guo*, Y. Zhou, X. Sang, D.N. Leonard, J. Qu*, J.D. Poplawsky, "Atom probe tomography unveils growth mechanisms of wear-protective tribofilms formed by ZDDP, ionic liquid, and their combination," *ACS Applied Materials & Interfaces* 9 (2017) 23152–23163.
12. Y. Zhou, J. Qu*, "Ionic liquids as lubricant additives – a review," *ACS Applied Materials & Interfaces* 9 (2017) 3209-3222.
13. A.H. Shaw, J. Qu*, C. Wang, R.D. England, "Tribological study of diesel piston skirt coatings in CJ-4 and PC-11 engine oils," *Wear* 376-377 (2017) 1673–1681.
14. J.W. McMurray, Y. Zhou, H.M. Luo, J. Qu, "Vaporization behavior of tetraoctylphosphonium bis(2-ethylhexyl)phosphate ionic liquid," *Chemical Physics Letters* 667 (2017) 55-61.
15. J.W. Robinson, Y. Zhou, J. Qu, J.T. Bays, L. Cosimbescu, "Highly branched polyethylenes as lubricant viscosity and friction modifiers," *Reactive and Functional Polymers* 109 (2016) 52-55.
16. P. J. Blau, J. Qu, R. Lu, "Modeling of complex wear behavior associated with grid-to-rod fretting in light water nuclear reactors," *JOM* 68 (2016) 2938-2943.
17. L. Cosimbescu, J.W. Robinson, Y. Zhou, J. Qu, "Dual Functional Star Polymers for Lubricants," *RSC Advances* 6 (2016) 86259-86268.
18. W.C. Barnhill, H. Luo, H.M. Meyer, C. Ma, M. Chi, B.L. Papke, J. Qu*, "Tertiary and quaternary ammonium-phosphate ionic liquids as lubricant additives," *Tribology Letters* 63 (2016) 22.
19. H. Jiang, J. Qu, R.Y. Lu, J.J. Wang, "Grid-to-rod flow-induced impact study for PWR fuel in reactor," *Progress in Nuclear Energy* 91 (2016) 355–361.
20. K. Jin, C. Lu, L.M. Wang, J. Qu, W.J. Weber, Y. Zhang, H. Bei, "Controlling chemical complexity: path toward swelling-resistant alloys," *Scripta Materialia* 119 (2016) 65–70.
21. R.A.E. Wright, K. Wang, J. Qu*, B. Zhao*, "Oil-soluble polymer brush-grafted nanoparticles as effective lubricant additives for friction and wear reduction," *Angewandte Chemie International Edition* 55 (2016) 8656–8660.

22. J. Qu*, P.J. Blau, C. Higdon, B.A. Cook, "Friction behavior of a multi-interface system and improved performance by $AlMgB_{14}$-TiB_2-C and diamond-like-carbon coatings," *Tribology International* 99 (2016) 182-186.
23. J.W. Robinson, Y. Zhou, R. Erck, J. Qu, J.T. Bays, L. Cosimbescu, "Effects of star-shape poly(alkyl methacrylate) arm uniformity on lubricant properties," *Journal of Applied Polymer Science* 133 (2016) 43611.
24. J. Qu*, K.M. Cooley, A.H. Shaw, R.Y. Lu, P.J. Blau, "Assessment of wear coefficients of nuclear zirconium claddings without and with pre-oxidation," *Wear* 356-357 (2016) 17-22.
25. A.K. Landauer, W.C. Barnhill, J. Qu*, "Correlating mechanical properties and anti-wear performance of tribofilms formed by ionic liquids, ZDDP and their combinations," *Wear* 354-355 (2016) 78-82.
    - *Featured article in ORNL 2016 Annual Report*
26. C. Xie, T. Toops, M. Lance, J. Qu, M. Viola, S. Lewis, D. Leonard, E. Hagaman, "Impact of lubricant additives on the physicochemical properties and activity of three way catalysts," *Catalysts* 6 (2016) 54.
27. J. Robinson, Y. Zhou, P. Bhattacharya, R. Erck, J. Qu, J. Bays, L. Cosimbescu, "Probing the molecular design of hyper-branched aryl polyesters towards lubricant applications," *Scientific Reports* 6 (2016) 18624.
28. W.C. Barnhill, H. Gao, B. Kheireddin, B.L. Papke, H. Luo, B.H. West, J. Qu*, "Tribological bench and engine dynamometer tests of a low viscosity SAE 0W-16 engine oil using a combination of ionic liquid and ZDDP as anti-wear additives," *Frontiers in Mechanical Engineering* 1 (2015) 12.
29. Y. Zhou, D.N. Leonard, H.M. Meyer, H. Luo, J. Qu*, "Does the use of diamond-like carbon coating and organophosphate lubricant additive together causes excessive tribochemical material removal?" *Advanced Materials Interfaces* 2 (2015) 1500213.
30. W.F. Rohr, K. Nguyen, B.G. Bunting, J. Qu, "Feasibility of Observing Small Differences in Friction Mean Effective Pressure Between Different Lubricating Oil Formations using Small, Single-Cylinder Motored Engine Rig," *Tribology Transactions* 58 (2015) 1067–1075.
31. J. Qu*, H.M. Meyer III, Z.-B. Cai, C. Ma, H. Luo, "Characterization of ZDDP and ionic liquid tribofilms on non-metallic coatings providing insights of tribofilm formation mechanisms," *Wear* 332-333 (2015) 1273–1285.
32. Z.-B. Cai, Y. Zhou, J. Qu*, "Effect of oil temperature on tribological behavior of a lubricated steel−steel contact," *Wear* 332-333 (2015) 1158–1163.
33. W.C. Barnhill, J. Qu*, H. Luo, H.M. Meyer III, C. Ma, M. Chi, B.L. Papke, "Phosphonium-organophosphate ionic liquids as lubricant additives: effects of cation structure on physicochemical and tribological characteristics," *ACS Applied Materials & Interfaces* 6 (2014) 22585–22593.
34. Y. Zhou, J. Dyck, T. Graham, H. Luo, D.N. Leonard, J. Qu*, "Ionic liquids composed of phosphonium cations and organophosphate, carboxylate, and sulfonate as lubricant antiwear additives," *Langmuir* 30 (2014) 13301–13311.
    - *Featured article in ORNL 2014 Annual Report*
35. Z.-B. Cai, H.M. Meyer III, C. Ma, M. Chi, H. Luo, J. Qu*, "Comparison of the tribological behavior of steel-steel and Si_3N_4-steel contacts in lubricants with ZDDP or ionic liquid," *Wear* 319 (2014) 172–183.
36. H.H. Elsentriecy, J. Qu*, H. Luo, H.M. Meyer III, C. Ma, M. Chi, "Improving corrosion resistance of AZ31B magnesium alloy via a conversion coating produced by a protic ammonium-phosphate ionic liquid," *Thin Solid Films* 568 (2014) 44–51.
37. H.H. Elsentriecy, H. Luo, H.M. Meyer III, L.L. Grado, J. Qu*, "Effects of pretreatment and process temperature of a conversion coating produced by an aprotic ammonium-phosphate ionic liquid on magnesium corrosion protection," *Electrochimica Acta* 123 (2014) 58–65.
38. J. Qu*, H. Luo, M. Chi, C. Ma, P.J. Blau, S. Dai, M.B. Viola, "Comparison of an oil-miscible ionic liquid and ZDDP as a lubricant anti-wear additive," *Tribology International* 71 (2014) 88–97.
    – Top 20 most cited papers since 2012 in Tribology International.
39. W.D. Li, H. Bei, J. Qu, Y.F. Gao, "Effects of machine stiffness on the loading-displacement curve during spherical nano-indentation," *Journal of Materials Research* 28(14) (2013) 1903–1911.

40. G. Mordukhovich, J. Qu*, J.Y. Howe, S.S. Bair, B. Yu, H. Luo, D.J. Smolenski, P.J. Blau, B.G. Bunting, S. Dai, "A low-viscosity ionic liquid demonstrating superior lubricating performance from mixed to boundary lubrication," *Wear* 301 (2013) 740–746.
41. H. Li, S.K. Martha, R.R. Unocic, H. Luo, S. Dai, J. Qu*, "High cyclability of ionic liquid–produced TiO_2 nanotube arrays as an anode material for lithium-ion batteries," *Journal of Power Sources* 218 (2012) 88–92.
42. J. Qu*, D.G. Bansal, B. Yu, J. Howe, H. Luo, S. Dai, H. Li, P.J. Blau, B.G. Bunting, G. Mordukhovich, D.J. Smolenski, "Anti-wear performance and mechanism of an oil-miscible ionic liquid as a lubricant additive," *ACS Applied Materials & Interfaces 4* (2012) 997–1002.
– Invited candidature by the Scientific Secretariat for the ENI Award 2013.
43. B. Yu, D.G. Bansal, J. Qu*, X. Sun, H. Luo, S. Dai, P.J. Blau, B.G. Bunting, G. Mordukhovich, D.J. Smolenski, "Oil-miscible and non-corrosive phosphonium-based ionic liquids as candidate lubricant additives," *Wear* 289 (2012) 58–64.
– 3rd most cited paper since 2012 in WEAR.
44. J. Qu*, H. Li, J.J. Henry Jr., S.K. Martha, N.J. Dudney, H. Xu, M. Chi, M.J. Lance, S.M. Mahurin, T.M. Besmann, S. Dai, "Self-aligned Cu-Si core-shell nanowire array as a high-performance anode for Li-ion batteries," *Journal of Power Sources* 198 (2012) 312–317.
45. L. An, J. Qu, J. Luo, Y. Fan, L. Zhang, J. Liu, C. Xu, P.J. Blau, "Aluminum nanocomposites having wear resistance better than stainless steel," *Journal of Materials Research,* 26 (2011) 2479–2483.
46. C. Higdon, B. Cook, J. Harringa, A. Russell, J. Goldsmith, J. Qu, and P.J. Blau, "Friction and wear mechanisms in $AlMgB_{14}$-TiB_2 nanocoatings," *Wear* 271 (2011) 2111–2115.
47. J. Qu*, H. Xu, Z. Feng, D.A. Frederick, L. An, H. Heinrich, "Improving the tribological characteristics of aluminum 6061 alloy by surface compositing with sub-micro-size ceramic particles via friction stir processing," *Wear* 271 (2011) 1940–1945.
48. J. Qu*, H.M. Meyer III, P.J. Blau, B.G. Bunting, "Low-temperature colossal carbon supersaturation enables anti-wear boundary film formation for austenitic stainless steels in oil-lubricated environment," *Wear* 271 (2011) 1733–1738.
49. H. Li, J. Qu*, Q. Cui, H. Xu, H. Luo, M. Chi, R.A. Meisner, W. Wang, S. Dai, "TiO_2 nanotube arrays grown in ionic liquids: high-efficiencies in photocatalysis and pore-widening," ***Journal of Materials Chemistry*** 21 (2011) 9487–9490.
50. J. Qu*, M. Chi, H.M. Meyer III, P.J. Blau, S. Dai, H. Luo, "Nanostructure and composition of tribo-boundary films formed in ionic liquid lubrication," *Tribology Letters* 43 (2011) 205-211.
51. A.M. Kovalchenko, P.J. Blau, J. Qu, and S. Danyluk, "Scuffing initiation in metals sliding against copper under non-lubricated conditions," *Wear*, 271 (2011) 2998–3006.
52. B.A. Cook, J.L. Harringa, J. Anderegg, A.M. Russell, J. Qu, P. J. Blau, C. Higdon, A.A. Elmoursi, "Analysis of wear mechanisms in low friction, nanocomposite $AlMgB_{14}$-TiB_2 coatings," *Surface and Coatings Technology* 205 (2010) 2296-2301.
53. W. Li, P.J. Blau, J. Qu, S.J. Park, R.M. German, "Tribological behavior of die tool materials used for die compaction in powder metallurgy," *Powder Metallurgy* 53 (2010) 251-259.
54. F. Jiang, J. Qu, G. Fan, W. Jiang, D. Qiao, M.W. Freels, P.K. Liaw, H. Choo "Tribological studies of a Zr-based glass-forming alloy with different states," *Advanced Engineering Materials* 11 (2009) 925-931.
55. J. Qu*, P.J. Blau, S. Dai, H. Luo, H.M. Meyer III, "Ionic liquids as novel lubricants and additives for diesel engine applications," *Tribology Letters* 35 (2009) 181-189.
56. M. Beltowksi. P.J. Blau, J. Qu, "Wear of spheroidal graphite cast irons for tractor drive train components," *Wear* 267 (2009) 1752-1756.
57. H. Xu, C.R. Hubbard, K. An, Z. Feng, X.-L. Wang, J. Qu*, "Neutron diffraction measurement of residual stresses in friction stir processed nanocomposite surface layer," *Advanced Engineering Materials* 11 (2009) 650-653.
58. J. Qu*, P.J. Blau, S. Dai, H. Luo, H.M. Meyer III, J.J. Truhan, "Tribological characteristics of aluminum alloys against steel lubricated by imidazolium and ammonium ionic liquids," *Wear* 267 (2009) 1226-1231.

59. J. Qu*, P.J. Blau, B.C. Jolly, "Oxygen-diffused titanium as a candidate brake rotor material," *Wear* 267 (2009) 818-822.
60. P.J. Blau, M. Yao, J. Qu, J. Wu, "Use of multiple criteria to map the high-temperature scuffing behavior of Co-based superalloys," *Wear* 267 (2009) 374-379.
61. J. Qu*, H. Xu, Z. Feng, K. An, R. Battiste, L. An, H. Heinrich, "Forming Al-Al_2O_3 nanocomposite surfaces using friction stir processing," *Transactions of NAMRI/SME* 37 (2009) 349-356.
62. J. Qu*, P.J. Blau, J.Y. Howe, H.M. Meyer III, "Oxygen diffusion enables anti-wear boundary film formation on titanium surfaces in zinc-dialkyl-dithiophosphate (ZDDP)-containing lubricants," *Scripta Materialia* 60 (2009) 886-889.
63. J. Qu*, P.J. Blau, L. Zhang, H. Xu, "Effects of multiple treatments of low-temperature colossal supersaturation on tribological characteristics of austenitic stainless steels," *Wear* 265 (2008) 1909-1913.
64. J. Qu*, P.J. Blau, "A New model to calculate friction coefficients and shear stresses in thermal drilling," *ASME Journal of Manufacturing Science and Engineering* 130 (2008) 014502.
65. C.C. Klepper, J.M. Williams, J.J. Truhan, J. Qu, L. Riester, R.C. Hazelton, J.J. Moschella, P.J. Blau, J.P. Anderson, O.O. Popoola, M.D. Keitz, "Tribo-mechanical properties of thin boron coatings deposited on polished cobalt alloy surfaces for orthopedic applications," *Thin Solid Films* 516 (2008) 3070-3080.
66. T.W. Liao, F.M. Tang, J. Qu, P.J. Blau, "Grinding wheel condition monitoring with boosted minimum distance classifiers," *Mechanical Systems and Signal Processing* 22 (2008) 217-232.
67. J. Qu*, P.J. Blau, V.K. Sikka, "Measurement of the resistance of treated metal foils to scrubbing abrasion using a modified reciprocating wear test," *Journal of ASTM International* 4 (2007) Paper ID JAI101294.
68. J. Qu*, P.J. Blau, B.C. Jolly, "Tribological properties of stainless steels treated by colossal carbon supersaturation," *Wear* 263 (2007) 719-726.
69. P.J. Blau, B.C. Jolly, J. Qu, W.H. Peter, C.A. Blue, "Tribological investigation of titanium-based materials for brakes," *Wear* 263 (2007) 1202-1211.
70. J.J. Truhan, R. Menon F. LeClaire, J. Wallin, J. Qu, P.J. Blau, "The friction and wear of various hard-face claddings for deep-hole drilling," *Wear* 263 (2007) 234-239.
71. T.W. Liao, C.F. Ting, J. Qu, P.J. Blau, "A wavelet-based methodology for grinding wheel condition monitoring," *International Journal of Machine Tools & Manufacture* 47 (2007) 580-592.
72. J. Qu*, J.J. Truhan, P.J. Blau, R. Ott, "The development of a pin-on-twin scuffing test to evaluate materials for heavy duty diesel fuel injectors," *Tribology Transactions* 50 (2007) 50-57.
73. T.W. Liao, G. Hua, J. Qu, P.J. Blau, "Grinding wheel condition monitoring with hidden markov model-based clustering methods," *Machining Science and Technology* 10 (2006) 511-538.
74. J. Qu*, J.J. Truhan, "An efficient method for accurately determining wear volumes of sliders with non-flat wear scars and compound curvatures," *Wear* 261 (2006) 848-855.
75. J. Qu*, J.J. Truhan, S. Dai, H. Luo, P.J. Blau, "Ionic liquids with ammonium cations as lubricants or additives," *Tribology Letters* 22 (2006) 207-214.
    – All-time top 10 most cited papers in Tribology Letters
76. S.F. Miller, C.C. Kao, A.J. Shih, J. Qu, "Investigation of wire electrical discharge machining of thin cross-sections and compliant mechanisms," *International Journal of Machine Tools & Manufacture* 45 (2005) 1641-1740.
77. J. Qu*, A.J. Shih, R. Scattergood, J. Luo, "Abrasive micro-blasting to improve surface integrity of electrical discharge machined WC-Co composite," *Journal of Materials Processing Technology* 166 (2005) 440-448.
78. J. Qu*, J.J. Truhan, P.J. Blau, H.M. Meyer III, "Scuffing transition diagrams for heavy duty diesel fuel injector materials in ultra low-sulfur fuel-lubricated environment," *Wear* 259 (2005) 1031-1040.
79. J.J. Truhan, J. Qu, P.J. Blau, "The effect of lubricating oil condition on the friction and wear of piston ring and cylinder liner materials in a reciprocating bench test," *Wear* 259 (2005) 1048-1055.
80. J. Qu*, P.J. Blau, T.R. Watkins, O.B. Cavin, N.S. Kulkarni, "Friction and wear of titanium alloys sliding against metal, polymer, and ceramic counterfaces," *Wear* 258 (2005) 1348-1356.

81. J. Qu*, J.J. Truhan, P.J. Blau, "Evaluating candidate materials for heavy duty diesel fuel injectors using a 'pin-on-twin' scuffing test," *Tribology International* 38 (2005) 381-390.
82. J. Qu*, J.J. Truhan, P.J. Blau, "Detecting the onset of localized scuffing with the pin-on-twin fuel-lubricated test for heavy duty diesel fuel injectors," *International Journal of Engine Research* 6 (2005) 1-9.
83. J.J. Truhan, J. Qu, P.J. Blau, "A rig test to measure friction and wear of heavy duty diesel engine piston rings and cylinder liners using realistic lubricants," *Tribology International* 38 (2005) 211-218.
84. J. Qu*, J.J. Truhan, P.J. Blau, "Application of the ASTM loop abrasion test to cylindrical specimens," *Journal of Testing and Evaluation*, JTE12508 33 (2005) 527-531.
85. J. Qu*, P.J. Blau, J. Klett, B. Jolly, "Sliding friction and wear characteristics of novel graphitic foam materials," *Tribology Letters* 17 (2004) 879-886.
86. C.W. Hardin, J. Qu, A.J. Shih, "Fixed abrasive diamond wire saw slicing of single crystal silicon carbide wafers," *Materials and Manufacturing Processes* 19 (2004) 355–367.
87. J. Qu*, R. Sarma, "The continuous non-linear approximation of procedurally defined curves using integral B-splines," *Engineering with Computers* 20 (2004) 22-30.
88. S.F. Miller, A.J. Shih, J. Qu, "Investigation of the spark cycle on material removal rate in wire electrical discharge machining of advanced materials," *International Journal of Machine Tools & Manufacture* 44 (2004) 391-400.
89. J. Patten, R. Fesperman, S. Kumar, S. McSpadden, J. Qu, M. Lance, R. Nemanich, J. Huening, "High-pressure phase transformation of silicon nitride," *Applied Physics Letters* 83 (2003) 4740-4742.
90. J. Qu*, A.J. Shih, "Analytical surface roughness parameters of a theoretical profile consisting of elliptical arcs," *Machining Science and Technology* 7 (2003) 281-294.
91. J. Qu, L. Riester, A.J. Shih, R. Scattergood, E. Lara-Curzio, T. Watkins, "Nanoindentation characterization of surface layers of electrical discharge machined WC-Co," *Materials Science and Engineering-A* 334 (2003) 125-131.
92. J. Qu, A.J. Shih, R. Scattergood, "Development of the cylindrical wire electrical discharge machining process, part II: surface integrity and roundness," *ASME Journal of Manufacturing Science and Engineering* 124 (2002) 708-714.
93. J. Qu, A.J. Shih, R. Scattergood, "Development of the cylindrical wire electrical discharge machining process, part I: concept, design, and material removal rate," *ASME Journal of Manufacturing Science and Engineering* 124 (2002) 702-707.
94. J. Qu*, G.X. Zhang, "Environmental error compensation of displacement interferometry system," *Chinese Aviation Engine* 104 (2001) 43-44, 3.
95. J. Qu, R. Sarma, "Least square curve and surface localization for shape conformance checking," *SME Journal of Manufacturing Systems* 19 (2000) 297-304.
– Reprinted from Transactions of NAMRI/SME 27 (1999) 275-280 as an Outstanding Paper Award Finalist
96. D.G. Li, G.X. Zhang, J. Qu, "Comprehensive compensation for the environmental error factor in high-accuracy laser interferometry," *Chinese Opto-Electronic Engineering* 26 (1999) 28-33.
97. C.S. Dong, J. Qu, J.X. Wang, G.X. Zhang, Y.H. Mu, "Description of motion accuracy in coordinate measuring machines," *Chinese Aviation Precision Manufacturing Technology* 34 (1998) 32-34.
98. B.H. Zhuang, W.W. Zhang, S.G. Feng, J. Qu, D. Cui, "Inner and exterior surface measurement using laser triangulation," *Chinese Measuring Techniques* 8 (1995) 44-47.

- **Conference Proceedings** (>20, *available upon request*)

INVITED TALKS AT CONFERENCES

1. "Antagonism between advanced coatings and lubricants?" *8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)*, Seattle, WA, Oct. 14–17, 2016.

2. "Ionic liquids as novel lubricant additives and their compatibility with other lubricant additives and non-ferrous materials," *2016 Tribology Gordon Research Conference*, Lewiston, ME, Jun. 26 – Jul. 1, 2016
3. "Oil-miscible ionic liquids as multi-functional additives for low-viscosity engine lubricants," *20th International Colloquium Tribology*, Stuttgart, Germany, Jan. 12-14, 2016.
4. "Using ionic liquids as anti-wear additives to lubricate non-metallic surfaces," *20th International Colloquium Tribology*, Stuttgart, Germany, Jan. 12-14, 2016.
5. "Low-viscosity lubricants using ionic liquids as base stocks or additives," Symposium on Molecular Chemistry and Lubricant Rheology, *STLE 70th Annual Meeting*, Dallas, TX, May 17-21, 2015.
6. "Oil-miscible ionic liquids as lubricant additives" in Panel Discussion: Ionic Liquids for Lubrication, *STLE 69th Annual Meeting*, Orlando, FL, May 18-22, 2014.
7. "Ionic Liquids as Next Generation Anti-wear Additives: Molecular Design to Engine Dynamometer Testing," *38th Automotive/Petroleum Industry Forum (Detroit Advisory Panel)*, Dearborn, MI, Apr. 16, 2014.
8. "Ionic Liquid-Additized Engine Oil for Improved Fuel Efficiency," *SAE 2014 High Efficiency IC Engine Symposium*, Detroit, MI, Apr. 6-7, 2014.
9. "Ionic liquids as novel lubricants or lubricant additives," *SAE 2012 High Efficiency IC Engines Symposium*, Detroit, MI, Apr. 22-23, 2012.
10. "Investigation of wear and surface damage on wind turbine bearing components" in Panel Discussion: U.S. DOE National Laboratory Research into Improvements in Reliability and Performance of Wind Turbine Drivetrains, *67th STLE Annual Meeting*, St. Louis, MO, May 6-10, 2012.
11. "Advanced surface treatments and coatings for improving tribological properties," Keynote Talk in Symposium for Hardfacing Coatings for Wear and Corrosion Resistance Applications, *Materials Science & Technology 2010 Conference*, Houston, TX, Oct. 17-21, 2010.
12. "Oxygen diffusion dramatically improves wear-resistance for titanium alloys," *Global Powertrain Congress - North America*, Chicago, IL, Oct. 14-15, 2008.
13. "Tribological properties of stainless steels treated by colossal carbon supersaturation," Keynote Talk in the Session of Surface Modifications and Coatings, *16th International Conference on Wear of Materials*, Montreal, Quebec, Canada, Apr. 15-19, 2007.
14. "Advanced low-friction high-wear-resistant lightweight materials," *Institute for Defense and Government Advancement (IDGA)'s 4th: Next Generation Materials for Defense Conference*, Arlington, VA, Feb. 28 - Mar. 1, 2006.
15. "An efficient method for determining wear volumes of sliders with non-flat wear scars" in Panel Discussion: Instrumentation and Techniques for Wear Measurement, *STLE 61st Annual Meeting*, Calgary, Alberta, Canada, May 7-11, 2006.