# Jun Qu, Ph.D.

Group Leader, Distinguished R&D Staff

Surface Engineering & Tribology Group

Oak Ridge National Laboratory (ORNL**)**

Fellow, STLE

*Google scholar citations*: 6600+, *h*-index: 44

P.O. Box 2008, MS 6063

Oak Ridge, TN 37831

Phone: (865) 576-9304 (office)

E-mail: [qujn@ornl.gov](mailto:qujn@ornl.gov)

*Standardized citation metric*: Top 100,000 of the most-cited scientists across all fields, 2019

**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

* **11/2021 – present *Group Leader*, Surface Engineering & Tribology Group, Materials Science & Technology Division (MSTD), ORNL**
* 10/2020 – 10/2021 *Group Leader*, Materials Processing Group, MSTD, ORNL
* **01/2016 – present *Distinguished R&D Staff*, MSTD, ORNL**
* 10/2011 – 12/2015 *Senior R&D Staff*, MSTD, ORNL
* 01/2007 – 9/2011 *R&D Staff,* MSTD, ORNL
* 02/2004 – 12/2006 *Associate R&D Staff*, Metals & Ceramics Division (M&C), ORNL
* 05/2002 – 2/2004 *Postdoctoral Research Associate*, M&C, ORNL

**RESEARCH**

* ***Current Interests***:
  + Eco-friendly, energy-efficient **Lubrication**
  + Superlubricity and wear resistant **Surface Engineering**
  + **Nanomaterials processing** for sealing and thermal management
  + **Manufacturing** for tribological applications
  + **Interfacial Phenomena** with combined mechanical, thermal, and chemical interactions
* ***Goals***: Improved energy efficiency and sustainability with reduced environmental impact
* ***Applications***: Automotive (both IC and EV), concentrating solar power, biomass preprocessing, hydropower, hydraulics, HVAC, and nuclear

### HONORS

* **Fellow**, ***Society of Tribologists & Lubrication Engineers* (STLE)** since 2017
* **2022 R&D 100 Award Finalist** (Team Lead), jointly with Danfoss, A high-efficiency carbon nanotube-coated mesh seal, *R&D Magazine*
* **2020 Distinguished Researcher Award**, Recognition of sustained and distinguished accomplishments with high impact in science and engineering, *ORNL/UT-Battelle Awards Night* (ORNL Highest Researcher Award, limited to 2 awardees per year and once for the career)
* **2020 R&D 100 Award Finalist** (Team Lead), A superlubricity coating composed of vertically aligned carbon nanotubes, *R&D Magazine*
* **2014 R&D 100 Award** (Team Lead), jointly among ORNL, GM, Shell, and Lubrizol, Ionic liquid anti-wear additives for fuel-efficient engine lubricants, *R&D Magazine*
* **2014 DOE Vehicle Technologies Office R&D Award**, Development of novel ionic liquid engine oil additives with potential to deliver a 2% fuel economy improvement, *U.S. Depart. of Energy*
* **2009 SME Outstanding Young Manufacturing Engineer Award**, Recognition of significant achievement & leadership in manufacturing engineering, *Society of Manufacturing Engineers*
* 2015 Invited Attendee to U.S. NAE Frontiers of Engineering Symposium, *National Academy of Engineering (NAE)*
* 2015 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
* 2014 ORNL Significant Event Award, Development of lubricant that meets DOE goal of 2 percent vehicle fuel economy improvement
* 2011 ORNL Significant Event Award, Breakthrough in ionic liquid lubricants recognized by a major DOE program award
* ORNL Performance Awards2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2021
* **1999 NAMRC Outstanding Paper Award Finalist**, *SME North American Manufacturing Research Conference*

**MEDIA REPORTS**

1. “ORNL’s latest on bio-oils corrosion and degradation: The Digest’s 2020 multi-slide guide to Oak Ridge National Laboratory,” *Biofuels Digest*, Jan. 10, 2021.
2. “ORNL team shows using ionic liquid as lubricant additive improves gear performance,” *Green Car Congress*, Sept. 8, 2019.
3. Featured at Frontiers of Engineering Alumni Spotlight, *National Academy of Engineering (NAE),* June 17, 2019.
4. “Finding Alternatives to ZDDP,” *Lubes ’n’ Greases*, November 2018, p. 44-48.
5. “ORNL, Shell develop a less friction/wear hybrid lubricant additive,” *World Industrial Reporter*, Sept. 2, 2015.
6. “Reduce wear with synergistic lubricant pair,” *Materials Views*, July 28, 2015.
7. “Low-friction engine oil,” *R&D Magazine*, August 19, 2014.
8. “National lab: New oil additive saves 2% on gas,” *USA Today,* July 28, 2014.
9. “Lab rolls out ideas for future vehicles,” *Detroit Free Press,* July 27, 2014.
10. “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.
11. “Molten salts could improve fuel economy,” *Inside Science News*, Nov. 15, 2013.
12. “Lubricating titanium,” *Tribology & Lubrication Technology,* Nov. 2012.
13. “Unleashing the potential of ionic liquids,” *Tribology & Lubrication Technology,* Apr. 2010.
14. “Nanocoatings boost industrial energy efficiency,” *Science Daily*, Nov. 2008.
15. “Supersaturated steel could save energy in factories,” *Science Daily*, Aug. 2007.

**AFFILIATIONS AND PROFESSIONAL ACTIVITIES**

* Professional Societies
  + ***Fellow***, **Society of Tribologists & Lubrication Engineers** (**STLE**), 2017–present
  + **Wear of Materials***Board of Directors*, 2019–present
  + **STLE** *Fellows Committee*, 2022–present
  + **SAE** *Fuels and Lubricants TC 3 Driveline and Chassis Lubrication Committee*, 2022–present
  + **ASTM International***, G2 on Wear and Erosion and* *D2 on Petroleum Products, Liquid Fuels, and Lubricants*,2017–present
* Conference Organizing
  + **Conference Chair**, ***24th International Conference on Wear of Materials***, Banff, Canada, April 16–20, 2023 (WoM 2023)
  + ***STLE Annual Meeting Planning Committee*** *(AMPC)*, 2019–present
  + Program Chair, *23rd International Conference on Wear of Materials*, Virtual, April 25–29, 2021 (WoM 2021)
  + Organizing Committee/Associate Editor, *17th, 21st and 22nd International Conference on Wear of Materials*, 2009, 2017, and 2019.
  + Organizer, Symposium for Hardfacing Coatings for Wear and Corrosion Resistance Applications, *Materials Science & Technology (MS&T) 2010 and 2012*.
* Journal Editing
  + *Associate Editor*, **ASME Journal of Tribology**, 2020–present
  + *Associate Editor*, **Friction**, 2020–present
  + *Associate Editor*, **Lubricants**, 2017–present
    1. Editor, Special Issue *Advanced Lubrication for Energy Efficiency II,* 2020–21
    2. Editor, Special Issue *Advanced Lubrication for Energy Efficiency,* 2018
  + *Associate Editor*, **Frontiers in Mechanical Engineering**, 2015–present
    1. Co-Editor, Special Issue *Ionic Liquids in Tribology*, 2020–21.
    2. Editor, Special Issue *Advanced Tribology and Lubrication: From Nanoscale Phenomena to Real World Applications,* 2018–19.
  + *Key Reader*, Metallurgical and Materials Transactions A, 2013–2022
  + *Technical Editor*, Tribology & Lubrication Technology, 2009–14.
* Government
  + U.S. Representative, **International Energy Agency (IEA)** *Advanced Materials for Transportation (AMT) Technology Collaboration Programme (TCP)*, 2022–present
  + **U.S. DoD** *Military Vehicle Industry Consortium (MVIC) on Fluid Modernization*, 2020–present
  + U.S. DOE *Lubricants Working Group*, 2015–18
  + National Academy of Engineering (NAE)’s *2015 U.S. NAE Frontiers of Engineering Symposium*

**SELECTED RESEARCH PROJECTS**

* *Eco-friendly, energy-efficient* ***Lubrication***

1. Organic-modified CNTs as lubricant additives for enhanced lubricity and thermal management of EVs (PI, DOE VTO 2022-24; CRADA w/ Valvoline)
2. Eco-friendly high-lubricity ionic liquids for hydraulic and hydropower lubrication (DOE VTO LabCall 2018-20; DOE WPTO Seedling 2021 & Sapling 2022; ORNL TIP 2020-22, collaboration w/ Solvay and Driven Racing Oil)
3. Ionic liquids as novel lubricant additives for HVAC compressors for enhanced efficiency and durability (PI, DOE TCF CRADA w/ Trane, 2021-22)
4. Tribocorrosion in molten salts for concentrating solar power and nuclear reactors (Task PI, DOE NE 2020-2021; DOE SETO FOA 2018-20, collaboration w/ Hayward Tyler)
5. Organic-modified nanoparticles and metal-complexes as additives for low-viscosity lubricants (DOE VTO FOA 2015-17 collaboration w/ UTK, UCM, and Cool-X; Hyundai 2019-20)
6. Ionic liquids as novel lubricant additives for automotive applications (PI, ORNL Seed 2005-06; DOE CRADA w/ GM 2009-13; DOE FOA CRADA w/ Shell 2012-15; DOE VTO FOA w/ GM 2015-19)
7. Investigation of the wear mechanism of sooted engine oils (PI, DOE w/ Cummins 2016-18)
8. Compatibility of between lubricant additives and non-ferrous alloys/coatings (PI, DOE VTO 2013-18)
9. Hyperbranched polymers for improved viscosity and lubricity (co-PI, DOE VTO FOA w/ PNNL 2014-16)
10. Diesel fuel injector lubrication and scuffing in ultra-low sulfur fuels (co-PI, DOE VTO 2002-05)
11. Effects of engine oil aging on friction and wear behavior (co-PI, DOE VTO 2002-05)

* *Superlubricity and wear resistant* ***Surface Engineering***

1. Superlubricity carbon nanotube (CNT) coating (PI, ORNL Seed 2018-19, DOE VTO 2022-24)
2. Wear resistant coatings for improving the durability of biomass comminution equipment (PI, Task 1 Lead of DOE BETO Feedstock-Conversion Interface Consortium 2018-24, collaborations among multiple national labs (ORNL, INL, ANL, and NREL) and a number of industrial partners including Forest Concepts, Rawlings Manufacturing, Eberbach, etc.)
3. Grid-to-rod fretting of candidate accident-tolerant fuel cladding materials and coatings (DOE NE CASL 2014-17; FOA 2018-20, collaboration with Westinghouse and General Atomics)
4. Advanced heavy-duty diesel engine piston skirt coatings (PI, DOE VTO CRADA w/ Cummins 2015-16)
5. Surface texturing for friction and wear reduction (PI, DOE VTO 2014)
6. Ionic liquids-processed anti-corrosion coatings for Mg alloys (PI, ORNL Seed 2012-14)
7. Nanostructured superhydrophobic coatings for drag reduction and anti-corrosion (PI, DOE ITP FOA w/ Ross Tech and SIT 2009-12)
8. Development of AlMgB14-based nanostructured superhard coatings for hydraulic and tooling systems (co-PI, DOE ITP FOA CRADA w/ Eaton, Ames Lab, and Greenleaf 2007-10)
9. Friction stir-based surface nanocompositing process for aluminum alloys (PI, ORNL LDRD 2006-08)
10. Low-temperature colossal carbon supersaturation for austenitic stainless steels (co-PI, DOE ITP FOA w/ Swagelok and CWRU 2005-08)
11. Surface engineering of titanium alloys for diesel engine and brake applications (PI, DOE VTO 2004-08)

* ***Nanomaterials Processing*** *for energy storage and thermal management*

1. Carbon nanotubes (CNTs) for friction and thermal management for electric vehicles (EVs) (PI, DOE VTO 2022-24)
2. CNTs-based high-efficiency seals for turbomachinery for concentrating solar power (PI, DOE SETO FOA award w/ Danfoss 2020-23).
3. Processing high-quality, low-defect TiO2 nanotubes using ionic liquids for Li-ion batteries & photoelectrochemical water splitting (PI, DOE ITP FOA 2009-11)
4. Development of a self-aligned Cu-Si core-shell nanowire array as a novel anode for Li-ion batteries (PI, ORNL Seed 2010-11)

* ***Manufacturing***

1. Laser melting and binder jetting to produce novel tribological materials and structures for automotive (PI, Ford Alliance 2018-20)
2. Additive manufacturing of wear-resistant composite coatings for military applications (PI, DOD AMRDEC 2017)
3. Thermal drilling of lightweight alloys (co-PI, DOE VTO w/ U Michigan 2005-07)
4. High-speed titanium machining (co-PI, DOE VTO w/ TWS and U Michigan 2004-06)
5. Grindability of ceramics and TiC-Ni3Al composites (co-PI, DOE VTO w/ LSU 2005)
6. Development of cylindrical wire electrical discharge machining of metals and MMCs (NC State, Ph.D. dissertation 1999-2002)

**RESEARCH GRANTS** (*43 grants of $28M including 22 collaborated with industry, lead-PI for 31 grants of $19M*)

* + 1. J. Qu (PI), G. Fenske (ANL), J. Lacey (INL), J.R. Keiser, V. Thompson (INL), “Understand and mitigate equipment wear in preprocessing,” DOE EERE BETO FCIC 2.1 Task 1, $1,725,000 ($696,000 to ORNL), 2022-24.
    2. J. Qu (PI), C. Kumara, H. Wang, “Carbon nanotube (CNT) coatings for superlubricity & thermal management of HD EVs,” DOE EERE VTO, $450,000, 2022-23.
    3. J. Qu (PI), C. Kumara, H. Wang, “New lubricant strategies for advanced thermal management of HD EVs,” CRADA with Valvoline, DOE EERE VTO, $450,000, 2022-23.
    4. J. Qu (PI), T. Mathews, H.M. Luo, “Novel eco-friendly high-lubricity ionic liquids for marine turbomachinery lubrication,” Collaboration with Driven Racing Oil and Solvay, DOE EERE WPTO Marine Energy Sapling (competitive solicitation), $250,000, 2022-23.
    5. J. Qu (PI), T. Li (Danfoss PI), M.B. Dobrica (Danfoss), C. Kumara, “Vertically-aligned carbon nanotube arrays as novel self-lubricating high-efficiency brush seal for CSP turbomachinery,” Collaboration with Danfoss, DOE EERE SETO DE-FOA-0002064 (competitive solicitation), $1,400,000 ($897,000 to ORNL), 2020-23.
    6. J. Qu (PI), J.R. Keiser, G. Fenske (ANL), D.N. Lanning (Forest Concepts), “Investigating and addressing the wear issue of the rotary shear biomass comminution system,” CRADA with Forest Concepts, DOE EERE BETO FCIC DFO (competitive solicitation), $1,200,000 ($900,000 to ORNL), 2019-23.
    7. J. Qu (PI), W. Akram (Trane), H.M. Luo, E. Sorenson (Trane), “Ionic liquids as novel lubricant additives for HVAC compressors for enhanced efficiency and durability,” CRADA with Trane, DOE OTT Technology Commercialization Fund (TCF, competitive solicitation), $225,000, 2021-23.
    8. J. Qu (Task lead), “Grid-to-rod fretting of candidate accident-tolerant fuel claddings,” Collaboration with Westinghouse Electric and General Atomics, DOE NE FOA, $440,000, 2018-22.
    9. J. Qu (PI), H.M. Luo, T. Mathews, X. He, “Eco-friendly, high-lubricity ionic liquids as lubricant additives for hydraulics,” Collaboration with Driven Racing Oil and Solvay, ORNL Technology Innovation Program (TIP, competitive solicitation), $200,000, 2020-22.
    10. B. Cook (Novus, PI), J. Qu, "Advanced coatings for improved diesel engine durability and efficiency," Collaboration with Novus, DOE SBIR DE-FOA-0001941, $150,000 ($49,000 to ORNL), 2020-22.
    11. J. Qu (PI), H.M. Luo, T. Mathews, “Novel eco-friendly high-lubricity ionic liquids for marine turbomachinery lubrication,” DOE EERE WPTO Marine Energy Seedling (competitive solicitation), $50,000, 2021.
    12. J. Qu (PI), J.R. Keiser, J. Lacey (INL), V. Thompson (INL), G. Fenske (ANL), “Understand and mitigation equipment wear in preprocessing,” DOE EERE BETO FCIC Task 1, $2,008,000 ($724,000 to ORNL), 2019-21.
    13. J. Qu (PI), “Organic-modified nanoparticles and metal-complexes as novel additives for low-viscosity lubricants,” Hyundai Motors, $370,800, 2019-21.
    14. B.G. Hardy (Hayward Tyler PI), K.R. Robb (ORNL PI), J. Qu, J.R. Keiser, D.L. Barth (HTSD), “Development of high-temperature molten salt pump technology for gen3 solar power tower systems,” Collaboration with Hayward Tyler, DOE EERE SETO FOA (competitive solicitation), $2,000,000 ($1,100,000 to ORNL), 2018-21.
    15. G. Fenske (ANL PI), J. Qu (ORNL PI), L. Cosimbescu (PNNL PI), “High performance fluids and coatings to improve efficiency, productivity, durability, and environmental compatibility of off-road hydraulic components,” DOE EERE VTO LabCall (competitive solicitation), $1,965,000 ($491,250 to ORNL), 2018-20.
    16. J. Qu (PI), Hamed Ghaednia (Ford), Arup Gangopadhyay, (Ford), A.M. Elliott, R.R. Dehoff, “Additive manufacturing opportunities to reduce friction and wear of engine components,” CRADA with Ford, Ford Alliance Program, $400,000, 2018-20.
    17. R. Elander (NREL PI), J. Qu (co-lead), J.R. Keiser, E. Kuhn (NREL), G. Fenske (ANL), “Understand and mitigation equipment wear in low-temperature pre-conversion,” DOE EERE BETO FCIC, $287,000 ($152,000 to ORNL), 2019.
    18. J. Qu (PI), M.B. Viola (GM PI), H.M. Luo, T.J. Toops, “Development of ionic liquid-additized, GF-5/6 compatible low-viscosity oils for automotive engine and rear axle lubrication for 4% improved fuel economy,” Collaboration with GM and Driven Racing Oil, DOE EERE VTO and DOD TARDEC DE-FOA-0000991 (competitive solicitation), $1,276,000 ($1,085,000 to ORNL), 2015-19.
    19. J. Qu (PI), P. Menchhofer (co-lead), “CNT-modified oleophilic surfaces for lubricant-starved applications,” ORNL LDRD Seed (competitive solicitation), $190,000, 2018-19.
    20. G. Muralidharan (PI), J.A. Haynes, D.N. Leonard, B.A. Pint, J. Qu, H. Wang, “Low-cost, high strength Ni-Fe-Cr alloys for high temperature applications,” ORNL TIP (competitive solicitation), $190,000, 2018-19.
    21. J.R. Keiser (PI), J. Qu (co-lead), “Investigation of machinery wear in biomass pre-processing and pre-conversion,” DOE EERE BETO FCIC, $400,000, 2018.
    22. J. Qu (PI), “Surface analysis of tribological films,” Shell Global Solutions, $50,000, 2018.
    23. J. Qu (PI), “Compatibility of lubricant additives with non-ferrous bearing alloys and coatings,” DOE EERE VTO, $1,000,000, 2013-18.
    24. J. Qu (PI), Y. Zhou, “Investigation of the wear mechanism of sooted engine oils,” Collaboration with Cummins, DOE EERE VTO, $75,000, 2017-18.
    25. J. Qu (PI), “Wear-resistant composite coatings replacing Cr-plating,” DOD AMRDEC, $110,000, 2017.
    26. B. Zhao (UTK PI), J. Qu (co-lead), A. Martini (UCM), S. Dai, H.M. Luo, B. Armstrong, “Hybrid ionic-nano-additives for engine lubrication to improve fuel efficiency,” DOE EERE VTO DE-FOA-0000988 (competitive solicitation), $898,000 ($280,000 to ORNL), 2015-17.
    27. J. Qu (Task lead), P.J. Blau, “Grid-to-rod fretting testing and modeling” Collaboration with Westinghouse Electric, DOE NEO CASL, $1,000,000, 2014-17.
    28. D. Leith (Cool-X PI), J. Qu (co-lead), B.H. West, “Nanodiamond lubricant additives,” Collaboration with Cool-X, DOE EERE VTO Voucher (competitive solicitation), $100,000 (all to ORNL), 2016-17.
    29. J. Qu (Task lead), R. England (Cummins), G. Muralidharan, “Investigating and addressing wear in a lightweight heavy-duty diesel engine,” Collaboration with Cummins, DOE EERE VTO, CRADA, $250,000, 2015-16.
    30. L. Cosimbescu (PNNL PI), J. Qu, P. Bhattacharya (PNNL), T. Bays (PNNL), S. Sluder, “Modified temperature-responsive hyperbranched polymers for improved viscosity and enhanced lubricity,” DOE EERE VTO DE-FOA-0000793 (competitive solicitation), $1,000,000 ($100,000 to ORNL), 2014-16.
    31. J. Qu (PI), B.L. Papke (Shell), B.G. Bunting, P.J. Blau, S. Dai, H.M. Luo, C. Chen (Shell), “Ionic liquids as multi-functional lubricant additives to enhance engine efficiency,” CRADA with Shell, DOE EERE VTO DE-FOA-0000239 (competitive solicitation), $1,200,000 (all to ORNL), 2012-15.
    32. J. Qu (PI), H.M. Luo, H.H. Elsentriecy, G.-L. Song, “Corrosion prevention of magnesium alloys via surface conversion treatments using ionic liquids,” ORNL LDRD Seed (competitive solicitation), $190,000, 2013-14.
    33. J. Qu (PI), P.J. Blau, S. Dai, H.M. Luo, B.G. Bunting, C. Kim, S.C. Tung (GM), E.W. Schneider (GM), “Ionic liquids as novel lubricants for engine applications,” CRADA with GM, DOE EERE VTO, $1,000,000 (all to ORNL), 2009-13.
    34. J. Qu (PI), “High performance anode for Li-Ion batteries,” Collaboration with Bren-Tronic Energy Systems, UT-Battelle’s PFTT Maturation Fund (competitive solicitation), $50,000, 2012-13.
    35. J. Qu (PI), J. Simpson (co-lead), V.K. Sikka, D. Speicher (Ross), A. Jones (Ross), C.H. Choi (RIT), “Nanostructured superhydrophobic coatings for breakthrough energy savings,” Collaboration with Ross Technologies, DOE EERE ITP FOA Nanomanufacturing Initiative (competitive solicitation), $1,995,000 (all to ORNL), 2009-12.
    36. J. Qu (PI), H.M. Luo, N.J. Dudney, D. Ma, “Vertically-aligned Cu-Si core-shell nanowire array as a high-performance anode material for energy storage,” ORNL LDRD Seed (competitive solicitation), $183,000, 2010-11.
    37. J. Qu (PI) and S. Dai, “Synthesis of highly ordered TiO2 nanotubes using ionic liquids for photovoltaics applications,” DOE EERE ITP FOA Nanomanufacturing Initiative (competitive solicitation), $200,000, 2010-11.
    38. B. Lisowsky (Eaton PI), D. Zhu (Eaton), B. Cook (Ames Lab), P.J. Blau, J. Qu, V.K. Sikka, C.K. Jun, J. Goldsmith (Greenleaf), “Nanocoatings for high-efficiency industrial hydraulic and tooling systems,” Collaboration with Eaton and Greenleaf, DOE EERE ITP FOA DE-PS36-05GO95011 (competitive solicitation), $2,000,000 ($600,000 to ORNL), 2007-10.
    39. J. Qu (PI), Z. Feng, P.J. Blau, X.L. Wang, L. An, J.J. Truhan, E. Lara-Curzio1, H. Wang, S.A. David, “A novel process of thick nanocomposite surfaces for defense applications,” ORNL LDRD Fund (competitive solicitation), $600,000, 2007-08.
    40. J. Qu (PI), P.J. Blau, W.H. Peter, J. Kiggans, “Low-cost, high-performance titanium brake rotors,” ORNL MSTD Maturation Fund, $20,000, 2008.
    41. G.M. Ludtka (PI), J. Qu (co-lead), “Improving enamel-based coatings,” SSW Holding, $50,000, 2006-07.
    42. J. Qu (PI), J.J. Truhan, S. Dai, H.M. Luo, P.J. Blau, “Ionic liquids as novel lubricants,” ORNL LDRD Seed (competitive solicitation), $145,000, 2005-06.
    43. P.J. Blau (PI), J. Qu (co-lead), J. Klett, “Investigation of tribological properties of graphitic foam reinforced carbon-carbon composites,” ORNL LDRD Seed (competitive solicitation), $20,000, 2003.

**PATENTS**

1. C. Kumara, J. Qu, “Metal nanoparticles as lubricant additives,” U.S. Patent #11,370,988, Jun. 28, 2022.
2. J. Qu, H.M. Luo, “Ionic liquids containing symmetric quaternary phosphonium cations and phosphorus-containing anions, and their use as lubricant additives,” U.S. Patent #10,435,642, Oct. 8, 2019. [*Licensed to Driven Racing Oil in 2019*]
3. J. Qu, H.M. Luo, “Corrosion prevention of magnesium surfaces via surface conversion treatments using ionic liquids,” U.S. Patent #9,435,033, Sept. 6, 2016.
4. Z. Feng, J. Qu, M.L. Santella, T.Y. Pan, A.D. Roche, Y.U. Sheng-Tao, “Method of making nanoparticle reinforced metal matrix components,” U.S. Patent #9,023,128, May 5, 2015.
5. 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, Aug. 13, 2014.
6. 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, July 8, 2014.
7. J.A. Ambrose, G. Mackiewicz-Ludtka, V.K. Sikka, J. Qu, “Oven rack having integral lubricious, dry porcelain surface,” US Patent #8,739,773, June 3, 2014.
8. J. Qu, S. Dai, and H.M. Luo, "Method for synthesis of titanium dioxide nanotubes using ionic liquids," U.S. Patent #8,585,886, Nov. 19, 2013.
9. J. Qu, J.J. Truhan, S. Dai, H.M. 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*
10. J. Qu, C. Kumara, T. Li, “A High-Efficiency Seal Composed of Carbon Nanotubes,” U.S. Patent Application, 63/284,753, Dec. 1, 2021.
11. C. Kumara, J. Qu, P.A. Menchhofer, “Superlubricity coating containing carbon nanotubes,” U.S. Patent Application, 17/090,216, Nov. 5, 2020.
12. J. Qu, H.M. Luo, X. He, “Ionic liquids containing quaternary ammonium and phosphonium cations, and their use as environmentally friendly lubricant,” U.S. Patent Application 17/078,668, Oct. 23, 2020 and International Application PCT/US2021/043260, July 27, 2021.
13. J. Qu, W.C. Barnhill, H.M. Luo, B. Kheireddin, H. Gao, B.L. Papke, “Lubricant formulations containing phosphonium ionic liquids,” U.S. Patent Application 62/321,881, April 13, 2016.
14. J. Qu, H.M. 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.
15. 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.
16. J. Qu, H.M. 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, July 28, 2014.
17. J. Qu, T.M. Besmann, S. Dai, X. Zhang, “Multijunction hybrid solar cell incorporating vertically-aligned silicon nanowires with thin-films,” U.S. Patent Application 13/250,044, Sept. 30, 2011.
18. J. Qu, S. Dai, “Composite nanowire compositions and methods of synthesis,” U.S. Patent Application 12/904,559, Oct. 14, 2010.

**PUBLICATIONS**

*Standardized citation metric*: Top 100,000 of the most-cited scientists in 2019 across all fields; Top 1% of 2019 and top 2% of career life in the field of Mechanical Engineering & Transports

*Google Scholar citations*: 6600+, *h*-index: 44

<https://scholar.google.com/citations?user=kC_r23MAAAAJ&hl=en>

* + **Special Journal Issues Edited**

1. “Advanced Lubrication for Energy Efficiency II,” Ed. by J. Qu, W. Li, and C. Kumara, *Lubricants*, 2020-21.
2. “Ionic Liquids in Tribology,” Ed. by Y. Zhou, Harman Khare, and J. Qu, *Frontiers in Mechanical Engineering*, 2020-21.
3. “Advanced Tribology and Lubrication: From Nanoscale Phenomena to Real World Applications,” Ed. by J. Qu and A. Martini, *Frontiers in Mechanical Engineering*, 2018-19.
4. “Advanced Lubrication for Energy Efficiency,” Ed. by J. Qu and H. Ghaednia, *Lubricants*, 2018.

* **Book Chapters**

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2. 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.
3. 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.
4. 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.
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12. J. Qu\*, R. Sarma, “The continuous non-linear approximation of procedurally defined curves using integral B-splines,” *Engineering with Computers* 20 (2004) 22-30*.*
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14. 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.
15. 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*.*
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17. 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.
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1. J. Qu\*, G.X. Zhang, “Environmental error compensation of displacement interferometry system,” *Chinese Aviation Engine* 104 (2001) 43-44, 3.
2. 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.
3. 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.
4. 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** (22)

1. “High-Efficiency Low-Toxicity Ionic Liquids as Lubricant Additives,” Invited seminar at *Quaker Houghton* (virtual), Feb. 8, 2022.
2. “Development of eco-friendly ionic liquids as novel lubricant additives,” *ACS Spring 2021*, Apr. 5–16, Virtual.
3. “Ionic liquids as energy-efficient lubricant additives for engines and gears,” *SAE E34 Propulsion Lubricants Committee Meeting*, March 23–26, 2020, Savannah, GA. [*cancelled due to COVID-19*]
4. “Ionic Liquids as Lubricant Additives and Their Compatibility with Coatings,” Invited seminar at *Ingersoll Rand*, May 25, 2018.
5. “Ionic Liquids as Next-Generation Lubricant Additives and Their Compatibility with Advanced Coatings,” Invited seminar at *University of Nevada at Reno*, Mar. 31, 2017.
6. “Antagonism between advanced coatings and lubricants?” *8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)*, Seattle, WA, Oct. 14–17, 2016.
7. “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
8. “Ionic Liquids as Novel Lubricant Additives,” Invited seminar at *Rochester Institute of Technology*, Mar. 31, 2016.
9. “Oil-Miscible Ionic Liquids as Multi-Functional Lubricant Additives,” Invited seminar at *ExxonMobil Research and Engineering Company*, Mar. 23, 2016.
10. “Oil-miscible ionic liquids as multi-functional additives for low-viscosity engine lubricants,” *20th International Colloquium Tribology*, Stuttgart, Germany, Jan. 12-14, 2016.
11. “Using ionic liquids as anti-wear additives to lubricate non-metallic surfaces,” *20th International Colloquium Tribology*, Stuttgart, Germany, Jan. 12-14, 2016.
12. “Low-viscosity lubricants using ionic liquids as base stocks or additives,” Symposium on Molecular Chemistry and Lubricant Rheology, *The STLE 70th Annual Meeting*, Dallas, TX, May 17-21, 2015.
13. “Oil-miscible ionic liquids as lubricant additives” in Panel Discussion: Ionic Liquids for Lubrication, *The STLE 69th Annual Meeting*, Orlando, FL, May 18-22, 2014.
14. “Ionic Liquids as Next Generation Anti-wear Additives: Molecular Design to Engine Dynamometer Testing,” *38th Automotive/Petroleum Industry Forum (Detroit Advisory Panel)*, Dearborn, MI, April 16, 2014.
15. “Ionic Liquid-Additized Engine Oil for Improved Fuel Efficiency,” *SAE 2014 High Efficiency IC Engine Symposium*, Detroit, MI, April 6-7, 2014.
16. “Ionic liquids as novel lubricants or lubricant additives,” *SAE 2012 High Efficiency IC Engines Symposium*,Detroit, MI, Apr. 22-23, 2012.
17. “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, *The 67th STLE Annual Meeting*, St. Louis, MO, May 6-10, 2012.
18. “Advanced surface treatments and coatings for improving tribological properties,” Keynote Talk in the Symposium for Hardfacing Coatings for Wear and Corrosion Resistance Applications, *Materials Science & Technology 2010 Conference and Exhibition*, Houston, TX, Oct. 17-21, 2010.
19. “Oxygen diffusion dramatically improves wear-resistance for titanium alloys,” *Global Powertrain Congress - North America*, Chicago, IL, Oct. 14-15, 2008.
20. “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.
21. “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.
22. “An efficient method for determining wear volumes of sliders with non-flat wear scars” in Panel Discussion: Instrumentation and Techniques for Wear Measurement, *The STLE 61st Annual Meeting*, Calgary, Alberta, Canada, May 7-11, 2006.