

# Resume

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## Summary of Technical Expertise:

- The long form curriculum vitae and lists of papers/patents/awards is on my website: (<http://rexp2.com/cv-resume/>)
- Diverse research portfolio management: broad new materials and mechanical systems development involving wide range of physical, chemical, and engineering disciplines.
- Principal investigator responsible for internally funded \$2.6M annual research budget.
- 2020 External funding: Co-PI ONR Contract: \$1.65M, option for \$1.35M; team member CESMI grant \$764K; NSERC Canada CRD Grant \$270K.
- New product development and ideation:
  - Developed program winning and retaining tribological and structural materials technology for \$360M program, 2nd highest risk system, JSF CDA phase: F-35 Joint Strike Fighter STOVL aircraft engine (F135-PW-600) thrust vectoring three bearing swivel nozzle (3BSN) and roll post actuator.
  - Led development of 1650 °C antioxidant for carbon-carbon, enabler for higher energy military brakes (F-18) and hypersonic applications. Patent pending.
  - Led development and scale-up of phosphate AO for 2X thermal and catalytic oxidation protection of C-C.
  - Filed patent disclosures in 2020 on a sensor for Covid-19 virus detection in cabin air systems and for a robotic cabin sanitization system, now being marketed by Honeywell.
- Industry & University teaming: building multidisciplinary consortia for technology transfer, transition, development, problem solving, and monetization:
  - Carbon-carbon aircraft brake life multi-scale model development: mechanics, University of Illinois; oxidation, University of Calgary; tribology, Purdue University; combined model, Honeywell.
  - Carbon-carbon anti-oxidant (AO) technology: New AO chemistry, Southern Illinois University; AO-carbon nano-scale performance mechanism, University of Calgary; coating scale-up, Honeywell.
  - Chrome replacement alloy electroplate for high aspect ratio internal surfaces: University of Calgary
  - Spark anodize anti-corrosion coatings with polymer seals for aluminum and magnesium: U. Calgary.
  - Variable displacement axial piston jet fuel pump multi-scale lubrication model: Tribology, Purdue University; Cavitation, Notre Dame; combined model, Honeywell. Won ONR funding with no cost share.
  - Intrinsically damped electroformed bellows for hermetic sealing electromagnetic servo valves: mechanics multi scale modeling, University of Illinois; electrochemistry and coatings, University of Calgary; manufacturing, Stentech. Won NSERC CRD grant, partial funding.
- Invited lecturer to universities, industry and government funding agencies on how to make these relationships work for all involved. Familiar with all aspects of industry-university contracting.
- 33 years applied research and development experience co-located in an aerospace product design organization:
  - Developed materials for material enabled solutions for commercial (CF6, CFM56, HTF7000) and military (F404, F414, F100, F119, F135) engine fuel systems.
  - Developed anti-oxidant coatings and structure property process models for Carbon-Carbon composite aircraft brakes for commercial and military applications (A380, A330, F-18, JSF).
- Managed and performed multi-scale experiment & modeling for metal, carbon-carbon composite, ceramics and coatings: deterministic and probabilistic mechanical properties (tensile, fatigue, fracture mechanics, creep); corrosion (exposure, electrochemical, EIS); thermophysical. Emphasized mechanisms to explain product behavior.

## Education:

- **Master of Science in Materials Science & Engineering**  
**University of Notre Dame**, 1995  
Thesis: Thermo-mechanical processing and crystallographic texture in super alpha-2 titanium aluminide.
- **Bachelor of Science in Mechanical Engineering with Chemistry second major**  
**Valparaiso University**, 1986  
Senior Project: Digital automation of a gas chromatograph for combustion product analysis
- **Ohio University**, Fall 1986

**Employment:****University of Illinois at Urbana-Champaign (October 2020-present)**

- **Adjunct Research Assistant Professor of Mechanical Engineering**
  - Nuclear graphite post irradiation mechanical behavior research.

**REXP2 Research LLC (August 2020-present)**

- **Owner/president**
  - Consulting services
    - Wettability and electro wettability of nano materials (ceramics, carbon/graphite, polymers).
    - Proposal writing: additive manufacturing of composites;
    - Pursuing SBIR/STTR grants for mechanical, biomedical, and chemical product R&D.

**Honeywell Aerospace (1987 to May 2020)****• Sr. Principal Engineer/Scientist (2001-Present)**

- Promoted based on demonstrated performance transitioning new materials from research to critical program winning products: F-35 Joint Strike Fighter STOVL actuation and engine (F135) control systems.
- Industry-University-National Laboratory collaboration
  - Fundamental objective: develop and transition technology from NASA TRL 1 to TRL 6.
  - Mentored: 8 Post Docs, 11 PhDs, 7 MSs at 6 universities; 40 interns/coops and inspired 4 to pursue PhDs.
  - Proposed and won \$1.65M from the Office of Naval Research for axial piston pump fuel lubrication and cavitation research supporting collaboration with Purdue and Notre Dame.
  - Proposed and won matching funding (\$270K) from Canada's NSERC; partners: University of Calgary, Stentech; intrinsically damped electroformed nickel-cobalt bellows for servo valves for reduced cost.
  - Developed an managed collaborations with: University of Illinois, Urbana-Champaign, Purdue University, Notre Dame, University of Calgary, and Southern Illinois University: antioxidant coating technology and mechanism for carbon-carbon composites; micro mechanical models for carbon-carbon and nano crystalline nickel cobalt; tribological and cavitation models for axial piston fuel pumps; chrome replacement electroplated alloy coatings for corrosion and wear protection; spark anodize coatings for aluminum and magnesium corrosion protection and reduced fatigue strength loss.
  - Collaborated with Oak Ridge National Laboratory (user program), Argonne National Laboratory and Sandia National Laboratory on product design focused material property research.
  - Managed multi-scale modeling and experiment to link atomic structure to product performance.
- Internal research and development
  - Consistently won Honeywell Grants for Innovation and Growth (\$75K, 6 months): COPNA resins for C-C densification (patented); hydrophobic coatings for phosphate glass and C-C (patented); vibration assisted particulate infiltration of C-C prior to pitch densification (patented); Lignin for carbon fiber precursors (2 project wins); Chemical cross linking of pitch for high throughput C-C densification.
  - Developed and patented IOT based framework for aircraft brake health monitoring. Invented and patented solid state sensor for runway deicer detection to adjust life model for catalyst exposure events.
  - Implemented Beta-C titanium spring technology in fuel controls for lower weight and size. Published first hot fatigue and elasticity study. Developed JSF qualification test procedure still in use 15 years later.
  - Discovered and first published the mechanism for a new failure mode of severe (40 %) fatigue strength loss following anodization of large cross section rolled and forged aluminum-copper alloys. Developed spark anodize/polymer anti corrosion system to eliminate fatigue strength loss with U. Calgary.
  - Lead 3 site team developing ceramic antioxidant coatings for carbon-carbon capable of 1600 °C performance in aircraft brakes and hypersonic vehicles. Patent pending.
  - Applied probabilistics to the specification method for ceramic materials to MRB actions 95 %.
  - Consulted (2 years) for Honeywell Turbo-Technologies (Garrett Motion) and Caterpillar on main journal bearing seizures in large engine turbochargers; determined root cause and corrective action plan.

**Principal Engineer (1999-2000)**

- Developed program winning and retaining tribological materials technology JSF F-35 Joint Strike Fighter.
- Implemented probabilistic design methodology and infrastructure for highly stressed structural ceramics (silicon nitride, alumina) for use in prime reliable and flight critical components. Trained design engineers to design for ceramics considering fast fracture and time/cycle dependent fracture modes.
- Lead production implementation and supplier development for ceramics, PVD coatings and advanced metallics in axial piston motors.

**Senior Staff Engineer (1996-1998):**

- Developed design and tribological data for ceramics, PVD coatings and metals for tribological applications in jet fuel powered axial piston motors. Received AlliedSignal Technical Achievement Award for success.
- Developed probabilistic design data for silicon nitride ceramics for pressure vessels. Lead probabilistic analysis tool selection, experimental performance evaluation, and training.
- Saved \$1M/year by solving critical hot short cracking problem in leaded bronze cast into steel through metallographic and early 20<sup>th</sup> century historical literature research. Developed mechanical and tribological property data for alternative alloys to bronze materials which were no-longer available.

**Senior Engineer (1991-1995):**

- Designed functionally gradient electroplated refractory metal-nickel tribological and diffusion barrier coatings for NASP (hypersonic) hydrogen control valves. Built controlled atmosphere diffusion bond test facility.
- Recognized by ANL as an example of technology transfer leading to \$100K/year cost savings on government contracts (F119 engine for F-22 Advanced Tactical Fighter).
- Automated the tribology laboratory reducing labor by 60%.
- Enabled application of aluminum lithium and magnesium in fuel control bodies for weight savings.
- Developed prototype zirconia toughened alumina and silicon nitride valves for gas turbine fuel controls.
- Oak Ridge National Laboratory HTML User: high temperature cyclic, dynamic, and static fatigue in silicon nitride, X-ray residual stress to quantify machining damage, nano-indentation hardness of hard anodize coatings on aluminum related to solid particle erosion research at Argonne National Laboratory.

**Engineer (1988-1990):**

- Principal Investigator of the Advanced Materials Internal Research and Development Program: Ceramics for fuel and gas valves, light weight metals, high temperature materials. Top 5 % score in military reviews.
- Developed mass spectrometer based hydrogen gas seal test apparatus for use up to 840 °C.
- Designed and built high temperature tribometer for use to 1100 °C.
- Proposed and executed collaboration with University of Massachusetts on hot erosion in silicon nitride.

**Associate Engineer (1987):**

- Wrote winning proposals for hot hydrogen and oxygen valves, hypersonic National Aerospace Plane (X-30)

**Patents Publications, Presentations, Posters:**

- 15 issued Patents 2 patents pending, 2 disclosures in review. List available at: (<http://rexp2.com/cv-resume/>)
- 46 peer reviewed publications, h-index: 20 on [Google Scholar](#)
- 21 conference presentations and posters.

**Awards:**

- 2020 STLE - Walter D. Hodson Award Richardson, D., Sadeghi, F., Rateick, R., Rowan, S., "Dynamic Modeling of Floating Valve Plate Motion in an Axial Piston Pump" Tribology Transactions, Vol 61(4), pp. 683-693, 2018.
- 2014 STLE - Walter D. Hodson Award: Cross, A.T., Sadeghi, F., Cao, L., Rateick, R.G., and Rowen, S., "Flow Visualization in a Pocketed Thrust Washer," Tribology Transactions, 55:5, 571-581, 2012.
- 2013 Honeywell Technical Achievement Award: Chrome replacement electroplate coating development
- 2012 STLE Tribology Transactions, Surface Engineering Best Paper Award: Wang, C., Sadeghi, F., Wereley, S. T., Rateick, R. G., and Scott, R., "Experimental Investigation of Lubricant Extraction from a Micropocket," STLE Tribology Transactions, Vol. 54(3), pp. 404-16, 2011
- 2002 Honeywell Technical Achievement Award: "For outstanding and innovative contribution to the development of Three Bearing Swivel Duct," 2002.
- 1997: AlliedSignal Technical Achievement Award, "For outstanding contribution to AlliedSignal Inc. in the field of Advanced Materials for Low Lubricity Metering and Actuation Applications."
- First Place and Highest Technical Content awards for senior project presentation, American Society of Mechanical Engineers, Region VII Student Member Competition (1986). Topic: Computer Aided Chromatography.

**Professional Societies:**

- ASM International: Technical Books Committee (3 years); Notre Dame chapter chair (2 years), program chair, Short course instructor (Ashby methods for material selection); Meeting lecturer (Electrochemical corrosion theory from a historical perspective; Steel manufacturing history 1850-1920).

**Outside Interests:**

- Experimental microbiology, histology, photo microscopy. Restoration of antique scientific instrumentation, amateur machinist. Metallurgical/materials science historian. Designed/built an audio sound restoration studio.