



## BACKGROUND

Dr. Lanning is a Senior Engineer at ARCCA specializing in forensic analysis of mechanical failures and material degradation. He investigates consumer product failures and accidents involving industrial equipment, as well as performing laboratory analyses of material composition, structure, and properties. Dr. Lanning holds a Bachelor of Science degree in Materials Science and Engineering from Boise State University, a Master of Science degree in Materials Science and Engineering from Penn State University, and a Ph.D. in Materials Science and Engineering from the Georgia Institute of Technology. As a research team leader, he pioneered digital image correlation (DIC) deformation energy and fracture mechanics measurement techniques for flexible and ductile thin material systems. He also discovered a novel residual stress strengthening mechanism in multilayer ceramic capacitors (MLCCs) and has written software for motion tracking, optical strain measurement, colorimetry, robotics, and laboratory information management. As the manager of both academic and commercial research laboratories, he has experience managing mechanical, chemical, and optical hazards.

## AREAS OF SPECIALTY

- Forensic Analysis
  - Fracture Surface Analysis
  - Metal Corrosion
  - Polymer Oxidation and Degradation
  - Weld and Fastener Failures
  - Plumbing System Material Failures
- Consumer Product Failure Analysis
  - Distinguishing flaws and manufacturing defects from wear, tear, and operator error
  - Blenders, pressure cookers, coffee makers, cookware, vape pens, eyeglasses, bicycles, hand tools, power tools, safety equipment, auto parts, etc.
- Accident Investigation
- Industrial and Laboratory Safety
- Machine Design and Safeguarding
- Manufacturing and Material Processing
  - Tracing defects and damage to conditions in production, distribution, or service life
  - Shipping damage, corrosion, coating defects, surface scratches, surface contamination, foreign objects in food/beverage containers, etc.
- Material Characterization
  - Material Identification
  - Microstructure and Defects
  - Property Measurement
- Static and Dynamic Testing

## EDUCATION

Ph.D. in Materials Science and Engineering, Georgia Institute of Technology, May 2018

- Corcia Fellow, Lab Safety Officer, Lab Manager

Master of Science degree in Materials Science and Engineering, Penn State University, May 2012

- 3M Fellow, University Graduate Fellow, Ann C. Wilson Graduate Student Research Award

Bachelor of Science degree in Materials Science and Engineering, Boise State University, May 2009

- Summa Cum Laude; Top Ten Scholar; Tau Beta Pi Engineering Honors Society Treasurer; Langroise, Bookstore, and MSE Scholarships



## PROFESSIONAL EXPERIENCE

### January 2020 – Present | ARCCA, Incorporated | Senior Engineer

- Conducts forensic analysis of the fracture, fatigue, and degradation of materials
- Inspects accident scenes and failed components, including collection of material samples for analysis, photographing the scene, and reviewing case documents
- Performs laboratory material identification and characterization experiments using techniques such as FTIR, EDS, XRF, XRD, etc.
- Plans and executes experiments on exemplars to measure failure forces and mechanisms to aid in the reconstruction of device failures
- Designs and constructs custom test equipment, data acquisition systems, and analysis software
- Conducts research to improve tools and analyses used for automobile accident reconstruction

### July 2018—January 2020 | Varsity Tutors, Upwork, AJE, & Catalant | Independent Contractor

- **Consulting:** product development, material processing and testing, and data science
- **Writing:** Content creator for Matmatch.com; manuscript editor for American Journal Experts
- **Teaching:** chemistry, physics, geometry, algebra, calculus, business calculus, computer science, history, English composition, and material processing

### September 2018—March 2019 | Lab/Cor Materials, LLC | Materials Scientist & Lab Manager

- **Lab Management:** quality management (ISO 9001), safety compliance, inventory tracking, instrument maintenance, process development, and training/qualification of lab staff
- **Project Management:** onboarding new clients, project planning, budgeting, preparing reports, and invoicing
- **Services Offered:** mechanical testing, failure analysis, material identification, consumer product testing, new product development consulting, reverse engineering, GC-FID, FTIR, XRF, wet chemistry, fuel analysis, and microscopy
- **Industries Served:** clothing, cookware, hygiene, petroleum/energy, sports/entertainment, food processing, biomedical, defense, packaging, aerospace, and architecture

### August 2012—May 2018 | Georgia Institute of Technology | Graduate Research & Teaching Assistant

- **Research:** developed new fracture mechanics and stress analyses for ductile thin sheets
- **Lab Management:** research team leader, training, inventory, and collaborative research coordinator
- **Data Science:** data acquisition, robotics, statistics, computer vision, and research team data management
- **Safety:** equipment maintenance, chemical inventory, hazardous waste management, chemical safety officer, laser/radiation safety officer, and EHS liaison
- **Teaching:** 10 semesters lecturing, grading, planning projects, and holding office hours for MSE 2001 and MSE 3005

### August 2009—December 2011 | Pennsylvania State University | Graduate Research Assistant

- **Research:** novel residual stress strengthening mechanisms in multilayer ceramic capacitors
- **Roles:** research project lead, safety officer, written reports and oral presentations to the Center for Dielectric Studies

## ADDITIONAL SKILLS

- **Data Science:** Python; Mathematica; MATLAB; Computer Vision; Digital Image Correlation; Arduino; SolidWorks ANSYS; Elmer; Microsoft Office; LaTeX; Illustrator; Inkscape; Photoshop; GIMP
- **Materials Science:** Mechanical Properties of Materials; Fracture Mechanics; Fatigue; Failure Analysis; Crystallography; Thin Film Processing; Additive Manufacturing; Thermal Processing; Laser Machining; Electrolytic Processing; Mechanical Forming; Machining
- **Material Characterization:** Optical Microscopy; SEM; TEM; EDS; XRF; XRD; FTIR; GC-FID; Raman; Mechanical Testing; Metallography

## PUBLICATIONS

### Peer-Reviewed Journal Publications

1. **Lanning, W. R.** and Muhlstein, C. L. (In preparation). The energetic interpretation of strain fields around a propagating crack in ductile thin sheets
2. Collins, J. G., **Lanning, W. R.**, and Muhlstein, C. L. (In preparation). A Monte-Carlo strain field mining methodology to identify and minimize image boundary-induced errors in interpolated fields
3. **Lanning, W. R.**, Johnson, C. E., Javaid, S. S., & Muhlstein, C. L. (2019). *Mode I steady-state crack propagation through a fully-yielded ligament in thin ductile metal foils*. Theoretical and Applied Fracture Mechanics, 101, 141-151.
4. Javaid, S. S., **Lanning, W. R.**, & Muhlstein, C. L. (2019). *The development of zones of active plasticity during mode I steady-state crack growth in thin aluminum sheets*. Engineering Fracture Mechanics, 218, 106540.
5. **Lanning, W. R.**, Javaid, S. S., & Muhlstein, C. L. (2017). *Reconciling fracture toughness parameter contradictions in thin ductile metal sheets*. Fatigue & Fracture of Engineering Materials & Structures, 40(11), 1809-1824.
6. Collins, J. G., Dillon, G. P., Strauch, E. C., **Lanning, W. R.**, & Muhlstein, C. L. (2016). *Correlating bonded joint deformation with failure using a free surface strain field mining methodology*. Fatigue & Fracture of Engineering Materials & Structures, 39(9), 1124-1137.
7. **Lanning, W. R.**, & Muhlstein, C. L. (2014). *Strengthening Mechanisms in MLCCs: Residual Stress Versus Crack Tip Shielding*. Journal of the American Ceramic Society, 97(1), 283-289.

### Conference and Symposium Presentations, Posters, and Papers

1. *Image Correlation Strategies for Deformation Rate and Work Density Measurements in Thin Sheets*, invited talk, ASM International Puget Sound Chapter Meeting October 2018
2. *Fatigue Crack Growth and Fracture of Flexible Metallic Sheets*, invited talk, TMS 2017
3. *Ductile Crack Growth in Face-Centered Cubic Metal Nanosheets*, TMS 2016
4. *Length Scale Effects on the Toughening of Barium Titanate-Ni Laminate Composites*, TMS 2015
5. Quarterly progress reports and presentations to the Center for Dielectric Studies at PSU, 2009-2011