NICOLAS MOLINA VERGARA (RESUME)
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Profile Summary

Nicolas Molina obtained his M.Sc. in Mechanical & Metallurgical Engineering from the Pontificia Universidad Católica de Chile (#1 in Latin America Rank 2023), being awarded three tribology-oriented research internships in France, Poland, and USA, showcasing his current global perspective and adaptability. He is currently a Ph.D. student in Materials Science & Engineering at the University of Texas at Austin working under the supervision of Dr. Filippo Mangolini. His doctoral research focuses on diffusion processes in thin films. In May 2023, he was awarded the prestigious Elmer E. Klaus Fellowship by the Society of Tribologists and Lubrication Engineers. Among his other highlights are:

1. Trained in the operation, data acquisition, and data processing of over 20 instruments, with the first systematic compilation and writing of SOPs for his research group, **demonstrating his abilities to document and specialize in a wide range of cutting-edge techniques for his research and efficient troubleshooting through documentation**.
2. Publication of 7 peer-reviewed journal articles (3 first author, 4 co-author) with a total of 40 citations, and 4 presentations in scientific/engineering conferences, **demonstrating written and oral scientific communication skills**.
3. Graduate student mentor for K-12 teachers and first-year Ph.D. students, including an advanced teaching preparation certificate, **showing his community involvement and passion for teaching, planning, and execution of projects.**

Education

The University of Texas at Austin, Austin, TX — Aug 2020 – May 2025
Ph.D. in Materials Science and Engineering | GPA 4.0

- **Research thesis:** Spectroscopic and spectrometric evaluation of surface and bulk chemical processes occurring in solid thin film lubricants upon tribological testing and aging under different environmental conditions.
- **Relevant Coursework:** *Advanced Methods for Surface Analysis, Practical Electron Microscopy, Thin Film Mechanics*

Pontificia Universidad Católica de Chile, Santiago, Chile — Aug 2018 – Jul 2020
Master of Science in Engineering, Mechanical Engineering | Highest distinction (A+)

- **Research thesis:** Erosion under turbulent slurry flow — An experimental determination of particle impact conditions and distribution thereof by image processing.
- **Relevant Coursework:** *Nanoscience and Nanotechnology for Engineers, Surface Engineering and Tribology*

Pontificia Universidad Católica de Chile, Santiago, Chile — Mar 2014 – Jul 2018
Bachelor of Science in Engineering, Mechanical Engineering (major), Materials Science (minor) | Highest distinction (A+)

- **Relevant Coursework:** *Sustainable Energy, Environmental Degradation of Materials, Environmental Fluid Mechanics*

Highlighted Skills

Surface Analysis: ToF-SIMS, XPS, XRD, GIXRD, XRR, GISAXS, FIB, SEM, STEM (ADF, ABF), EDS, VASE, Profilometry
Cleanroom: PVD (E-beam, DC sputtering, RF sputtering) — Multilayer thin films of metals, oxides, and nitrides
Data driven analytics: Python (Matplotlib, Numpy, Scipy, CV2, Skimage), Mathematica, MATLAB, Maple
Computer-aided design: Autodesk Inventor Professional, Fusion 360
Languages: Spanish (*Native*)

Honors & Awards

Professional Development Award, Cockrell School of Engineering (UT Austin) — Dec 2023
Elmer E. Klaus Fellowship, Society of Tribologists and Lubrication Engineers (STLE) — May 2023
Alfred and Nellie King Graduate Fellowship, Cockrell School of Engineering (UT Austin) — Jun 2022
Grants in Aid of Research (GIAR), Sigma Xi, The Scientific Research Honor Society — Jun 2022
Best Master's Thesis, School of Engineering, Pontificia Universidad Católica de Chile — Jul 2020
Fully-Funded Master's Scholarship, National Research & Development Agency, Chile — Jan 2019
Fully-Funded Bachelors' Scholarship, National Research & Development Agency, Chile — Jan 2014

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Highlighted Research Experience

Institute for Sustainable Technologies (Łukasiewicz Research Network), Radom, Poland Aug 2019 – Sep 2019
International Research Intern

- Developed an image processing algorithm in Python for the automated detection of erosive wear scars using 3D coherence scanning interferometry (CSI)

Laboratory for Applied Surface Science (LASS), The University of Texas at Austin, Austin, TX Jan 2019 – Mar 2019
International Research Intern

- Identified a missing link in the scientific literature about the effects of halide impurities on the lubricating properties of a phosphonium-based ionic liquid

National Institute for Research in Digital Science and Technology (INRIA), Grenoble, France Jan 2018 – Mar 2018
International Research Intern

- Implemented and tested the Alternating Direction Method of Multipliers (ADMM) in Python within the context of accelerated numerical techniques for frictional contact problems (non-smooth dynamical systems)

Corrosion and Materials Degradation, Pontificia Universidad Católica de Chile, Santiago, Chile Mar 2017 – Sep 2018
Undergraduate Research Assistant

- Performed material degradation analysis on slurry pipelines subjected to different abrasive flow conditions

Academic Experience

School of Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile

Teaching Assistant Coordinator | Graduate Seminar (ICM3821) Mar 2020 - Jul 2020

- Coordinated research talks
- Managed the feedback system of the talks

Teaching Assistant Coordinator | Materials science (ICM2403) Aug 2018 - Dec 2018

- Managed the evaluation system
- Coordinated a team of 3 teaching assistants
- Elaborated tutorials, homework, study guides, laboratory guides, exam solutions

Teaching Assistant Coordinator | Properties and strength of materials (ING1024) Aug 2016 - Jul 2017

- Managed the evaluation system
- Coordinated a team of 15 teaching assistants
- Elaborated tutorials, homework, study guides, laboratory guides, exam solutions

Teaching Assistant | Properties and strength of materials (ING1024) Aug 2016 - Jul 2016

- Executed exercise and discussion sessions

Certifications

Center for Teaching and Learning, The University of Texas at Austin, Austin, TX Dec 2021

Advanced teaching preparation certificate

- Workshops devoted to learn about, observe, practice, receive feedback on, and reflect upon classroom teaching techniques. Contents: **1)** Students with disabilities: How do I provide equal access and foster inclusion through academic accommodations?, **2)** Understanding your role: How do I work effectively with students and faculty?, **3)** How we learn: How can I use pedagogical theory to make learning last?, **4)** Embracing (dis)comfort: What are some proactive strategies for unexpected classroom moments?, **5)** Drafting teaching statements: How do I articulate my beliefs about teaching?, **6)** Student well-being: How do I promote students' mental health in my teaching?, **7)** Teaching as research: How do I apply a scholarly lens to my teaching?

CIEN-UC, CSIC-Madrid-Spain, Pontificia Universidad Católica de Chile, Santiago, Chile Nov 2018

Materials characterization certificate

- Solid surface characterization by electron microscopy and spectroscopy (XPS, XAS, LEEM/PEEM, CEMS/ILEEMS)

Leadership & Community Involvement

Nanosystems Engineering Research Center (NASCENT), Austin, TX Jun 2022 – Jul 2022

Graduate student mentor for K-12 teachers

- Planning and execution of the research project: "*Effect of preloading on the annealing of diffusion couples*"
- Mentorship and training in the design of loading devices, sample preparation, SEM, EDS.
- Outcomes: Most outstanding mentor award (3rd place),

Nanosystems Engineering Research Center (NASCENT), Austin, TX Sep 2021 – Dec 2021

Graduate student mentor for first-year Ph.D. students

- Mentoring 2 first-year Ph.D. students from the Cockrell School of Engineering
- Weekly mentorship (time management, conflict management, laboratory best practices)

Nanosystems Engineering Research Center (NASCENT), Austin, TX Jun 2021 – Jul 2021

Graduate student mentor for K-12 teachers

- Planning and execution of the project: "*Testing the wettability of hydrophobic screen protectors sold on Amazon*"
- Mentorship and training in product design (concept generation, concept selection), and construction of 3D printed goniometer for middle school classroom activities

ATX Bridges International, Austin, TX Sep 2020 – Present

International student volunteer

- Connecting the diverse cultures of international and American students at UT through practical service, social connections, and spiritual exploration
- Activities: Support in weekly events (coordination, discussions, games)

Conferences

1. **2023 Tribology Frontiers Conference**, Ohio, US (Nov 2023). *Oral presentation*. Towards quantification of the depth-dependent diffusivity of water in molybdenum disulfide solid lubricant coatings.
2. **77th STLE Annual Meeting & Exhibition**, California, US (May 2023). *Poster presentation*. Spectroscopic evaluation of surface chemical processes occurring in MoS2 upon aging.
3. **2022 Tribology Conference GRC**, Maine, US (Jun 2022). *Poster presentation*. Tuning the surface reactivity and tribological performance of phosphonium-based ionic liquid at steel/steel interfaces by bromide/phosphate anion mixtures.
4. **22nd International Conference on Wear of Materials**, Miami, US (Apr 2019). *Oral presentation*. Application of FFT analysis for the study of directionality of wear scars in exposure to slurry flow of varying velocity.

Publications

1. **Molina, N.**, Curry, J. F., Babuska, T. F., Dugger, M. T., Dolocan, A., Rodin, G. J., Mangolini, F. (2024). Towards quantification of the depth-dependent diffusivity of water in molybdenum disulfide solid lubricant coatings. *Tribology & Lubrication Technology*, under review.
2. Chrostowski, R., Curry, J. F., Dugger, M. T., **Molina, N.**, Babuska, T. F., Celio, H., ... & Mangolini, F. (2023). Spectroscopic Evaluation of Surface Chemical Processes Occurring in MoS_2 upon Aging. *ACS Applied Materials & Interfaces*, 15(30), 37047-37058.
3. Espinoza-Jara, A., Walczak, M., **Molina, N.**, Jahn, W., & Brevis, W. (2022). Erosion under turbulent flow: A CFD-based simulation of near-wall turbulent impacts with experimental validation. *Engineering Applications of Computational Fluid Mechanics*, 16(1), 1526-1545.
4. Li, Z., Jennings, Z. Y., Yan, J., **Molina, N.**, Lien, H. M., Chrostowksi, R., ... & Mangolini, F. (2022). Effect of tribologically-induced changes in surface termination of silicon-containing diamond-like carbon coatings on the resistance to biomolecule adsorption. *Carbon*, 199, 132-140.
5. Li, Z., Celio, H., Dolocan, A., **Molina, N.**, Kershaw, J., Morales-Collazo, O., ... & Mangolini, F. (2021). Tuning the surface reactivity and tribological performance of phosphonium-based ionic liquid at steel/steel interfaces by bromide/phosphate anion mixtures. *Applied Surface Science*, 570, 151245.
6. **Molina, N.**, Walczak, M., Kalbarczyk, M., & Celentano, D. (2021). Erosion under turbulent slurry flow: Effect of particle size in determining impact velocity and wear correlation by inverse analysis. *Wear*, 474, 203651.
7. **Molina, N.**, Walczak, M., & Michalczewski, R. (2020). Erosion under turbulent slurry flow: An experimental determination of particle impact angle, impact direction, and distribution thereof by image processing. *Wear*, 454, 203302.
8. **Molina, N.**, Aguirre, J., & Walczak, M. (2019). Application of FFT analysis for the study of directionality of wear scars in exposure to slurry flow of varying velocity. *Wear*, 426, 589-595.