

ALEJANDRO BARRIOS

ajbarri@sandia.gov • (512) 709-4751 • 608 Palomas Dr, Albuquerque, NM 87108

SUMMARY OF EXPERTISE

Microscopy and Materials Characterization

- SEM and FIB Microscopy
- EDS, EBSD and TKD Characterization

Nano/Micromechanics

- In-situ SEM Micromechanical Testing
- Fatigue Testing in Small-Scale Materials

EDUCATION

Georgia Institute of Technology

December 2020

Ph.D., Mechanical Engineering

GPA – 3.79

Research Area: Mechanics of Materials

Georgia Institute of Technology

December 2018

Master of Science, Materials Science and Engineering

GPA – 3.81

Multidisciplinary Certificate in Mechanical Properties of Materials

The University of Texas at Austin

December 2015

Bachelor of Science, Mechanical Engineering with High Honors

GPA – 3.90

Bridges to the Future Certificate: Advanced Materials Engineering

Minor: Mathematics

RESEARCH EXPERIENCE

Sandia National Laboratories - CINT, Albuquerque, NM

08/2020 – Present

Postdoctoral Appointee, PI: Brad Boyce

Project Title: Nanomechanics and Nanometallurgy of Grain Boundaries

- Investigating the tensile and fatigue behavior of nanocrystalline Pt and Pt-Au as an effort to study the influence of mechanically-induced grain coarsening on the performance of these thin film metals
- Developing a methodology to fabricate gradient nanostructured metals via a compositionally gradient Pt-Au film and subsequent thermal annealing
- Employing in-situ SEM experiments to evaluate the mechanical performance of these metals, and EDS, EBSD, FIB liftouts and TKD to characterize their compositions and microstructures

Project Title: High-Throughput Fatigue Testing of Thin Films

- Fabricated high-throughput nanomechanical devices (Si frame with ~12 Al free-standing dogbones) via sputtering, double-sided maskless lithography and wet/dry etching in a cleanroom facility
- Designed and conducted in-situ SEM high-throughput experiments to study the low-cycle fatigue behavior of the Al dogbones, while concurrently gathering statistically significant data

Georgia Institute of Technology, Atlanta, GA

08/2016 – 08/2020

Graduate Research Assistant - Ph.D. Student, PI: Olivier Pierron

Project Title: Fatigue Mechanisms in Nickel Microbeams under Extreme Stress Gradients

- Investigated the nanoscale size effects of fatigue damage in the performance of Nickel MEMS
- Conducted in-situ SEM experiments to study surface crack nucleation and propagation
- Compared the environmental effects of fatigue damage in air and in vacuum
- Performed FIB cross-sections to evaluate the subsurface crack propagation mechanisms
- Developed a micromechanical technique to investigate both High and Low Cycle Fatigue

Empa, Swiss Laboratories for Materials Science and Technology, Thun, Switzerland

05/2019 – 08/2019

Visiting Ph.D. Student, PI: Xavier Maeder

- Utilized a FIB-SEM system coupled with an EBSD camera to fully characterize the Nickel microbeam
- Inspected 3D EBSD scans to assess crack nucleation and propagation characteristics and mechanisms
- Analyzed fatigue-induced grain coarsening in the Ultra Fined Grained region of the microbeam

- Sandia National Laboratories, Albuquerque, NM 06/2017 – 07/2017
 Nonlinear Mechanics and Dynamics (NOMAD) Researcher
- Calibrated plasticity constitutive models to experimental uniaxial tension data of Steel A286
 - Performed Finite Element simulations to reproduce experimental data for the tension of A286 fasteners
 - Utilized reduced order models to predict the behavior of untested fasteners under complex loadings
- Pontifical Catholic University of Chile – Escuela de Ingenieria, Santiago, Chile 06/2015 – 07/2015
 Mechanical Engineering Research Intern, PI: Jorge Ramos
- Assembled a Gigabot 3D printer and found optimal conditions and settings for printing complex parts
 - Investigated the effect of nozzle diameter on Fuse Deposition Modeling (FDM) 3D printing
 - Researched the mechanical properties of materials using the Medea atomistic simulation software
- The University of Texas at Austin – Materials Testing Laboratory, Austin, TX 01/2015 – 05/2015
 Undergraduate Research Assistant, PI: Desiderio Kovar
- Performed three sets of experiments using tensile testing frames and heating coils to characterize the rheological behavior of a polymer-ceramic composite

TEACHING AND MENTORING EXPERIENCE

- Georgia Institute of Technology – Mechanical Engineering, Atlanta, GA 05/2020 – 08/2020
 Graduate Teaching Assistant for Experimental Methods
- Conducted online lab sessions on mechanical, fluid, thermal and acoustic systems
 - Graded lab reports and provided valuable feedback to students
- Georgia Institute of Technology – Mechanical Engineering, Atlanta, GA 01/2020 – 05/2020
 Graduate Teaching Assistant for Creative Decisions and Design
- Conducted, along with an instructor, lab sessions on the engineering design methodologies
 - Trained students in woodworking and machining tools and managed tool usage during open lab hours
- The University of Texas at Austin – Cockrell School of Engineering, Austin, TX 09/2013 – 12/2015
 Equal Opportunity in Engineering (EOE) Tutor
- Tutored engineering students seeking help in engineering and math courses
 - Advised students on effective ways to study and on strategies for time management
 - Mentored students about the university resources available for them

PUBLICATIONS

- N.M. Heckman, A. Barrios, C.M. Barr, D.P. Adams, T.A. Furnish, K. Hattar, B.L. Boyce, “Solute segregation improves the high-cycle fatigue resistance of nanocrystalline Pt-Au” *Acta Materialia*, 2022. 229: 117794
- A. Barrios, Y. Zhang, X. Maeder, G.M. Castelluccio, O.N. Pierron, T. Zhu, “Abnormal grain growth in ultrafine grained Ni under high-cycle loading” *Scripta Materialia*, 2022. 209: 114372
- A. Barrios, E. Kakandar, G.M. Castelluccio and O.N. Pierron, “Comparison of the low and high/very high cycle fatigue behaviors in Ni microbeams under bending” *Journal of Materials Research*, 2021. 36(11): p. 2337-2348
- E. Kakandar, A. Barrios, J. Michler, X. Maeder, O.N. Pierron and G.M. Castelluccio, “A Computational and Experimental Comparison on the Nucleation of Fatigue Cracks in Statistical Volume Elements” *International Journal of Fatigue*, 2020. 137: 105633
- G. Cahn, A. Barrios, S. Graham, J. Meth, A. Antoniou and O.N. Pierron, “The role of strain localization on the electrical behavior of flexible and stretchable screen printed silver inks on polymer substrate” *Materialia*, 2020. 10: 100642
- E. Kakandar, G.M. Castelluccio, A. Barrios, O.N. Pierron and X. Maeder, “Computational and experimental study of crack initiation in statistical volume elements” *MATEC Web Conferences*, 2019. 300: 10001

S. Gupta, A. Barrios, N. England and O.N. Pierron, “Improved very high cycle bending fatigue behavior of Ni microbeams with Au coatings” *Acta Materialia*, 2018. 161: p. 444-455.

A. Barrios, S. Gupta, G.M. Castelluccio and O.N. Pierron, “Quantitative in Situ SEM High Cycle Fatigue: The Critical Role of Oxygen on Nanoscale-Void-Controlled Nucleation and Propagation of Small Cracks in Ni Microbeams” *Nano Letters*, 2018. 18(4): p. 2595-2602.

CONFERENCE ORAL PRESENTATIONS

A. Barrios, C. Kunka, J. Nogan, K. Hattar, and B.L. Boyce, “High-Throughput Fatigue Testing of Nanocrystalline Al Thin Films” TMS 2022, Anaheim, CA.

A. Barrios, E. Kakandar, Y. Zhang, T. Zhu, X. Maeder, G.M. Castelluccio and O.N. Pierron, “Characterization and Modeling of Fatigue-induced Grain Growth in Ultrafine Grained Ni” TMS 2021, virtual.

A. Barrios, E. Kakandar, Y. Zhang, T. Zhu, X. Maeder, G.M. Castelluccio and O.N. Pierron, “Fatigue Induced Grain Coarsening in Ultrafine Grained Nickel Microbeams” TMS 2020, San Diego, CA.

A. Barrios, E. Kakandar, X. Maeder, G.M. Castelluccio and O.N. Pierron “Fatigue Mechanisms in Nickel Microbeams under Extreme Stress Gradients” ICMCTF 2019, San Diego, CA.

A. Barrios, J. Alonso, E. Kakandar, G.M. Castelluccio and O.N. Pierron, “Effect of the Environment on Void-Controlled Fatigue Crack Nucleation and Propagation in Ni Microbeams” 12th International Fatigue Congress 2018, Poitiers, France.

A. Barrios, G.M. Castelluccio and O.N. Pierron, “In-Situ SEM High Cycle Fatigue Investigation of Small Fatigue Crack Growth in Ni Microbeams” 2017 MRS Fall Meeting, Boston, MA.

PROPOSAL WRITING

- CINT User Proposal, PI, “High-Throughput Fatigue Testing of Nanocrystalline Metallic Thin Films”
- CINT User Proposal, co-PI, “Abnormal grain growth in ultrafine grained metallic films under high cycle loading”
- NSF Proposal, main collaborator, “Abnormal Grain Growth Under Cyclic Loading” (under review)

SKILLS

- Fluent in English, Spanish and Portuguese
- Proficient in ABAQUS, ANSYS, AutoCAD, SolidWorks, and LabVIEW
- Programming skills: C++, MATLAB, Python and Excel VBA
- Proficient in Microsoft Excel, PowerPoint and Word

ACCOMPLISHMENTS AND AWARDS

- Outstanding Scholar-Leader Award, presented to a unique graduating senior in recognition of superior academic performance and exceptional leadership, December 2015
- Recipient, Good Neighbor Scholarship, competitive award for international students, 2014-2015
- Recipient, Friends of Alec International Student Scholarship Endowment, 2013-2014
- Recipient, T.C. & Grace T. Ho Endowed Scholarship, 2014-2015
- College Scholar, recognition to students ranked in the top 20% of their class, 2014 and 2015
- Engineering Scholar, recognition to the students placed on the top 5% of their class, 2013

PROFESSIONAL ACTIVITIES

- The Minerals, Metals & Materials Society (TMS), Member
- TMS Nanomechanical Behavior of Materials, Committee Member
- Materials Research Society (MRS), Member
- Peer Reviewer for *Acta Materialia* and *International Journal of Fatigue*