

Milad Khajehvand

Santa Clara, CA 95051 — khajehvand.milad@gmail.com — [LinkedIn](#) — [ORCID](#)

SUMMARY

- I hold a Ph.D. in Mechanical Engineering and have a comprehensive understanding of **materials science**, statistical mechanics, mechanics of materials, semiconductor physics, and advanced packaging and interconnects (especially wire bonding and flip-chip bonding). My experience includes extensive computational modeling, particularly focusing on solid-state bonding and plastic deformation in metals via LAMMPS molecular dynamics simulations. Additionally, I am proficient in visualizing and interpreting data from atomistic simulations using OVITO and Python. Alongside my computational skills, I possess a wide range of experimental expertise, including SEM/EDX, optical microscopy and profilometry, tensile testing, micro/nano-indentation, and ultrasonic wire bonding.

EDUCATION

- **Santa Clara University**, Santa Clara, CA, 09/2018 - 03/2024
 - Ph.D. in Mechanical Engineering (GPA: 3.74/4.00)
- **Santa Clara University**, Santa Clara, CA, 03/2016 - 09/2018
 - M.Sc. in Mechanical Engineering (GPA: 3.86/4.00, Emphasis: Materials Engineering)
- **Sharif University of Technology**, Tehran, Iran, 09/2010 - 09/2015
 - B.Sc. in Materials Engineering (GPA: 15.19/20.00)

RESEARCH EXPERIENCE

- **Graduate Research Assistant**, Santa Clara University, 03/2016 - 03/2024 (Advisor: Prof. P. Sepehrband)
 - Used a combination of computational and experimental approaches to provide atomistic insights into the mechanisms of ultrasonic bonding, a family of solid-state joining techniques that utilize high-frequency vibration parallel to the interface of two metallic parts to break surface oxides and enable bonding. Employed molecular dynamics simulations to study the atomic-scale contact formation between oxide-free regions of the ultrasonic bonding counterparts through the Jump-to-Contact mechanism and the evolution of the resultant interfacial dislocation network during the application of shear or vibration. Utilized an ultrasonic wire bonder, SEM/EDX, and optical profilometry to study bondpad damage in ultrasonic bonding.
- **Undergraduate Research Assistant**, Sharif University of Technology, 2013 - 2015 (Advisor: Prof. A. Akbarzadeh)
 - Investigated the mechanical properties of roll-bonded low-carbon steel/aluminum sheets reinforced by an internal stainless-steel net.

TEACHING EXPERIENCE

- **Graduate Teaching Assistant**, Santa Clara University, 03/2016 - 03/2024
 - **Introduction to Materials Science Lab** (Instructor: Prof. R. Marks)
 - † Performed tensile testing and optical microscopy, and explained some materials on crystallography, phase diagrams, solidification, and Hall-Petch relationship to students. Supervised students performing lab experiments and graded their lab reports.
 - **Device Electronics for IC Design Lab** (Instructor: Prof. C. Yang)
 - † Demonstrated the I-V and C-V characteristics of a diode and an N-Channel MOSFET to students using a curve tracer and an impedance analyzer. Answered students' questions on problem sets during recitation sessions. Graded their quizzes and homework assignments.
- **Grader**, Santa Clara University, 03/2016 - 03/2024
 - **Materials and Manufacturing Processes**
 - **Advanced Engineering Mathematics**
 - **Introduction to Mathematical Methods in Mechanical Engineering**

WORK EXPERIENCE

- **Process Pathfinding Intern**, Kulicke and Soffa Industries, Inc., Santa Ana, CA, 09/2022 - 03/2023
 - Studied bond formation at the early stages of ultrasonic wire bonding and provided pathfinding ideas for wedge bonding interconnection technology. (NSF Internship Program)
- **Materials Engineering Intern**, Iran Khodro Advanced Dies Manufacturing Co., Tehran, Iran, 06/2014 - 09/2014
 - Identified the issues in a progressive stamping die and suggested the correct value for die clearance based on the material and thickness of the sheet.

KNOWLEDGE & EXPERTISE

- **Knowledge**
 - Molecular Dynamics, Statistical Mechanics, Monte Carlo, Machine Learning, Crystallography, Dislocations, Grain Boundaries, Interfaces, Solid-state Physics, Thermodynamics, Diffusion, Heat Treatment, Metallurgy, Metals and Alloys, Semiconductor Physics and Device Fabrication, Advanced Packaging and Interconnects
- **Computer Skills**
 - LAMMPS, SPPARKS, OVITO, Python, MATLAB, SLURM, Abaqus, SolidWorks, Mathematica
- **Technical Skills**
 - SEM/EDX, Metallography, Optical Microscopy and Profilometry, Tensile Testing, Micro/nano-indentation, Ultrasonic Wire Bonding, Roll Bonding, Failure Analysis, Design of Experiments, Finite Element Analysis
- **Soft Skills**
 - Creativity, Resilience, Problem Solving, Attention to Detail, Communication

PUBLICATIONS

- **Journal**
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Unlocking insights in ultrasonic bonding – A molecular dynamics study," under revision for resubmission to Journal of Manufacturing Processes.
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Bond-pad damage in ultrasonic wedge bonding," Microelectronics Reliability 152 115279 (2024). [LINK](#)
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Interface-mediated shear behavior of bonded aluminum substrates," Journal of Materials Science 57 20957–20973 (2022). [LINK](#)
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Nanoscale contact behavior of (111) fcc metallic surfaces," Computational Materials Science 170 109149 (2019). [LINK](#)
 - M. Khajehvand, P. Sepehrband, "The effect of crystallographic misorientation and interfacial separation on jump-to-contact behavior and defect generation in aluminum," Modelling and Simulation in Materials Science and Engineering 26 055007 (2018). [LINK](#)
- **Thesis**
 - M. Khajehvand, "Atomistic insights into the mechanisms of ultrasonic bonding," Santa Clara University Engineering Ph.D. Theses 52 (2024). [LINK](#)
 - M. Khajehvand, "Crystal Misorientation and Defect Generation during Contact between Two Aluminum Substrates," Santa Clara University Mechanical Engineering Master's Theses 24 (2018). [LINK](#)
- **Conference Talk**
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Understanding the atomic-scale nature of ultrasonic wire bonding using molecular dynamics simulations," IMAPS2023 Wire Bonding Workshop, San Diego, CA (2023).
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Molecular dynamics study of the effect of ultrasonic vibration on evolution of crystal defects," TMS2020 conference, Symposium on Advanced Microelectronic Packaging, Emerging Interconnection Technology and Pb-free Solder, San Diego, CA (2020).
 - M. Khajehvand, P. Sepehrband, "Molecular dynamics study of the contact behavior of FCC metallic substrates," TMS2019 conference, Symposium on Interfaces in Structural Materials: An MPMD Symposium in Honor of Stephen M. Foiles, San Antonio, TX (2019).
 - M. Khajehvand, P. Sepehrband, "The Effect of Crystallographic Orientation on the Jump to Contact Behavior: A Molecular Dynamics Study," MS&T2017 conference, Symposium on Interfaces, Grain Boundaries and Surfaces from Atomistic and Macroscopic Approaches, Pittsburgh, PA (2017).
- **Conference Poster Presentation**
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "The impact of interface orientation on the vibration behavior of joined aluminum substrates," TMS2023 conference, Symposium on Deformation Mechanisms, Microstructure Evolution, and Mechanical Properties of Nanoscale Materials, San Diego, CA (2023).
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Molecular Dynamics Study of the Deformation Behavior of Metallic Substrates under Shear/Vibration," MS&T2022 conference, Symposium on Grain Boundaries, Interfaces, and Surfaces: Fundamental Structure-Property-Performance Relationships, Pittsburgh, PA (2022).
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Contact formation and defect generation at the interface of two FCC metallic substrates," IMECE2019 conference, NSF-Funded Research Poster Competition, Salt Lake City, UT (2019).
 - M. Khajehvand, H. Seppänen, P. Sepehrband, "Molecular dynamics study of the contact behavior of FCC metallic substrates," 47th Electronic Materials Symposium, Stanford, CA (2019).

GRADUATE COURSEWORK

- **Mechanical Engineering**
 - Introduction to Computational Materials — Introduction to Computational Mechanics — Finite Element Methods I, II, and III — Equilibrium Thermodynamics — Statistical Thermodynamics — Phase Equilibria and Transformations — Electronic Structure and Properties — Atomic Arrangement, Defects, and Mechanical Behavior — Fracture Mechanics and Fatigue — Elasticity — Design for Manufacturability — Polymer — Composite Materials I — Introduction to Alternative Energy Systems — Medical Device Case Studies — Nanoscale Science & Technology — Modern Instrumentation & Experimentation
- **Electrical Engineering**
 - Introduction to Integrated Circuit Materials — Integrated Circuit Fabrication Processes I — Fundamentals of Semiconductor Physics — Semiconductor Device Theory I
- **Computer Engineering**
 - Design & Analysis: Algorithms — Machine Learning
- **Mathematics**
 - Advanced Engineering Mathematics — Probability I and II

NOTABLE PROJECTS

- Trained two of my advisor's graduate students on Statistical Mechanics, Molecular Dynamics, LAMMPS, and OVITO and supervised them during the time that my advisor was on leave.
- Used Monte Carlo Potts model in SPPARKS to study the effect of initial grain size distribution on 2D grain growth (Introduction to Computational Materials course project, Instructor: Prof. P. Sepehrband).
- Calculated elastic constants of Xenon, assuming an FCC crystal structure and using Lennard-Jones 6-12 interatomic potential (Electronic Structures and Properties course project, Instructor: Prof. R. Marks).
- Studied the evolution of several methuselahs using the Game of Life algorithm and got familiar with the family of Cellular Automata models which are being used in materials science for modeling grain boundaries (Introduction to Computational Mechanics course project, Instructor: Prof. M. Taylor).
- Used 3-D bond-based Peridynamics theory to model tearing a rubber membrane, assuming a non-linear elasticity model for rubber (Introduction to Computational Mechanics course project, Instructor: Prof. M. Taylor).
- Used SEM to verify wear in a wedge bonding tool that had been used for making 1000 wire bonds (Advisor: Prof. P. Sepehrband).
- Studied the effect of pre-heat-treatment conditions on the deformation recovery of indented soda-lime glass after annealing. Performed indentation and visualized the surface profile AFM data via Python (Advisor: Prof. P. Sepehrband).

VOLUNTEER EXPERIENCES

- **2024 National STEM Challenge, 2023**
 - Judged STEM ideas proposed by middle and high school students who participated in this nationwide challenge designed to cultivate creativity, critical thinking, and a love for STEM among students.
- **Summer Engineering Seminar (SES), Santa Clara University, 2022**
 - Explained the effect of heat treatment on the ductility of metals and performed hardness testing on metallic samples heat treated at varied temperatures. The SES program is designed to motivate high school students from underrepresented populations to pursue science and engineering majors in college so that they can one day join the STEM workforce.
- **Life in the U.S. Student Pro-tips Panel, Santa Clara University, 2018**
 - As a member of the panel, provided tips to incoming international students on academics, social life, getting involved on campus, shopping, banking, food, and transportation.
- **LEAD Week Tour, Santa Clara University, 2017**
 - Showed the materials engineering facilities to first-year undergraduate students and explained the research projects that were being done in the lab. The LEAD Scholars Program is a program for first-generation college students focused on academic success, student leadership, and community engagement.
- **GetSET Program Summer Tour, Santa Clara University, 2017**
 - Explained the effect of annealing on the strength of materials to high-school-aged women. The purpose of this tour was to expose students to science, engineering, and technology fields.

AWARDS & HONORS

- Won Most Attractive Poster Award in the NSF-Funded Research Poster Competition at “IMECE2019 conference,” 2019.
- Won 2nd place Best Doctoral Research Poster Award in the “2019 School of Engineering Research Showcase” at Santa Clara University, 2019.
- Awarded full RA/TA scholarship at Santa Clara University, 03/2016 - 03/2024.
- Ranked in the top 1% among 320,000 participants in the “Iranian Nationwide University Entrance Examination,” and admitted to Sharif University of Technology, the most prestigious science & engineering school in Iran, 2010.