Exponent®
Engineering & Scientific Consulting

Alan Liu, Ph.D.

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Professional Profile

Dr. Liu specializes in the fracture-mechanical, thermal, and chemical characterization of mesoscopic materials and their interfaces. As an Associate at Exponent, he leverages his multidisciplinary background, which spans mechanical engineering, materials science and engineering, and chemical engineering, to solve complex engineering problems for clients on proactive and reactive projects. Dr. Liu has extensive experience in several materials characterization techniques such as macroscopic mechanical testing (adhesion testing, DMA, rheology, Instron testing), thin film mechanics (nanoindentation, double cantilever beam), spectroscopy (FTIR, UV-Vis, GCMS), thermal (DSC, TGA), profilometry, and optical microscopy. He has insights that span all materials length scales from microscopic to macroscopic, giving him an informed and balanced point of view that integrates well in cross-functional teams when given the opportunity. Additionally, his prior internship experiences in software engineering make him an adept user of machine learning and A.I. models and multiple programming languages (Java, Python, Bash/UNIX, MATLAB).

Prior to joining Exponent, Dr. Liu received his Ph.D. from Stanford University where he investigated the degradation mechanisms of solar module polymeric encapsulants that lead to fracture-mechanical failures at their interfaces (glass/encapsulant and cell/encapsulant). He has published multiple journal/conference papers and contributed to open-access materials reliability databases which are valuable to the solar industry for materials selection and design. Finally, he is an experienced communicator, having presented at more than 10 conferences and workshops.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Stanford University, 2025

M.S., Mechanical Engineering, Stanford University, 2022

B.S., Chemical Engineering, University of California, Berkeley, 2019

Publications

K. Liu, D. C. Miller, N. Bosco, Jimmy M. Newkirk, Reinhold H. Dauskardt, “Advancing Steady-State and Sequenced Accelerated Aging for Assessing Adhesion Degradation in Contemporary Encapsulants,” IEEE 53rd PVSC.

K. Liu, D. C. Miller, N. Bosco, J. M. Newkirk, T. Sakamoto and R. H. Dauskardt, “Investigating the Crosslinking, Degradation, and Adhesion Behavior of Photovoltaic Encapsulants Under Thermal Accelerated Aging,” in IEEE Journal of Photovoltaics,

K. Liu, D. C. Miller, N. Bosco and R. H. Dauskardt, “Determining the Crosslinking and Degradation Reaction Kinetics in Photovoltaic Encapsulants Using Accelerated Aging,” 2024 IEEE 52nd Photovoltaic

Specialist Conference (PVSC), Seattle, WA, USA, 2024, pp. 0909-0914, DOI: 10.1109/PVSC57443.2024.10749611

T.W. Colburn, K. Liu, A. Carbone, O. Elsafty, and R.H. Dauskardt, "Mechanical Design Guidelines to Inhibit Fracture in Perovskite Solar Cells," Solar RRL, 2024. DOI: 2400321

K. Liu, P. Thornton, Dagmar R. D'hooge, R.H. Dauskardt, "Predicting Encapsulation Delamination in Photovoltaic Modules Using Photochemical Reaction Kinetics and Fracture Mechanics," Progress in Photovoltaics, 2023. DOI: 10.1002/pip.3771

Presentations

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Why Solar Modules Don't Always Stay Stuck Together (Using Accelerated Testing and Multiscale Models to Save Their Sorry Interfaces)," Oral Presentation, DuraMAT Webinar, September 2025.

K. Liu, D. C. Miller, N. Bosco, J. M. Newkirk, R. H. Dauskardt, "Advancing Steady-State and Sequenced Accelerated Aging for Assessing Adhesion Degradation in Contemporary Encapsulants", Poster Presentation, 2025 IEEE PVSC Virtual Meeting, June 2025.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Steady-state and Sequenced Accelerated Aging to Reveal Degradation Pathways and Inform IEC Testing Standards", Poster Presentation, NREL Photovoltaic Reliability Workshop, Lakewood, CO, March 2025.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Degradation Mechanisms and the Role of Sequenced Accelerated Testing to Ensure Long-Term Solar Module Encapsulation", Durable Materials Consortium Fall 2024 Workshop, Berkeley, CA, September 2024.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Determining the Photochemical Degradation and Crosslinking Kinetics in Photovoltaic Encapsulants Using Accelerated Aging", Poster Presentation, 2024 HOPE Workshop, Golden, CO, July 2024.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Determining the Photochemical Degradation and Crosslinking Kinetics in Photovoltaic Encapsulants Using Accelerated Aging", Oral Presentation, 2024 IEEE PVSC, Seattle, WA, June 2024.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Predictive Mechanics and Photochemical Degradation Kinetics Modeling for Polymeric Encapsulants," Stanford MECON 2024, Oral and Poster Presentation, May 2024.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Predictive mechanics and photochemical degradation kinetics modeling for polymeric encapsulants," DuraMAT Webinar, Oral Presentation, April 2024.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Predictive mechanics and photochemical degradation kinetics modeling for polymeric encapsulants", Oral/Poster Presentations, NREL Photovoltaic Reliability Workshop, Lakewood, CO, February 2024.

K. Liu, D.C. Miller, N. Bosco, R.H. Dauskardt, "Improving Predictive Mechanics and Photochemical Degradation Kinetics Modeling for Polymeric Encapsulants", Oral Presentation, Durable Materials Consortium, Albuquerque, NM, September 2023.

K. Liu, R.H. Dauskardt, "Predictive fracture mechanics and photochemical reaction kinetics modeling of PV module reliability", Oral Presentation, Materials Research Society, San Francisco, CA, April 2023.

K. Liu, R.H. Dauskardt, "Predictive fracture mechanics and photochemical reaction kinetics modeling of PV module reliability", Oral Presentation, Durable Materials Consortium, Breckenridge, CO, August 2022.

Project Experience

- Conducted mechanical testing (adhesion, scratch, properties) of battery materials and protective coatings used in consumer electronic devices.
- Performed failure analysis of electronic hardware devices (displays, light-guides).

Peer Reviews

IEEE Journal of Photovoltaics (1 manuscript: JPV-2024-02-0059-R)

Nature Partner Journals Flexible Electronics (1 manuscript)

Solar Energy Materials and Solar Cells (1 manuscript: SOLMAT-D-25-02847)