

Nikhil Kar

PhD, PE

Senior Managing Consultant



Dr. Kar's expertise is in the fields of mechanical engineering, metallurgy, materials science, failure analysis, mechanical & material behavior, laboratory testing, contamination analysis, and equipment component function to determine cause(s) of failure. His consulting projects include failure analysis of consumer products, plumbing products, structural component failures/fractures, bicycles, aviation, automotive, industrial, and machine components, and medical or foreign object implants as related to personal injury, product liability, premise liability, construction defect and water loss or fire matters. He also consults on patent infringement matters and is a licensed Professional Engineer in California in both the mechanical and metallurgical/materials disciplines. As a former adjunct assistant professor of engineering practice, Dr. Kar has taught undergraduate and graduate courses for the Viterbi School of Engineering at the University of Southern California. He has qualified as an expert witness in State and Federal Court.

Education

PhD, Mechanical Engineering University of Southern California.
2012

MS, Mechanical Engineering University of Southern California.
2007

BS Mechanical Engineering (Cum Laude) University of California,
Irvine. 2006

Licenses & Certifications

- State of California P.E. License No. M36943 (Mechanical)
- State of California P.E. License No. MT 1982 (Metallurgical / Materials)

Contact Information

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ESi Santa Ana

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Areas of Specialization

- Engineering Failure Analysis
- Environmental Stress Cracking (ESC)
- Fractography
- Fracture of Welds and Weld Microstructure
- Fracture Mechanics of Engineering Materials and Products
- Materials Characterization Testing and Analysis
- Mechanical Behavior and Mechanical Testing of Materials
- Mechanical Equipment Function / Malfunction
- Microscopic and Metallographic Evaluation of Arcing and or Fire Damage Components
- Non-Metallic Materials – Polymers, Polymer Composites
- Corrosion
- Surface Analysis Characterization of Failed Electrical Components

Positions Held

Engineering Systems Inc., Santa Ana, California

- Senior Managing Consultant, 2025 – Present
- Regional Office Manager, 2024 – 2025

Kars' Testing and Research Laboratories – A Division of Engineering Systems, Inc., Anaheim, California

- Senior Managing Consultant, 2022 – 2025
- Regional Operations Manager, 2024 – 2025

Kars' Advanced Materials, Inc., Anaheim, California

- Principal Engineer, 2013 – 2022

Materia Inc., Pasadena, California

- Composites Research Manager, 2012 – 2013

University of Southern California, Los Angeles, California

- Adjunct Assistant Professor of Chemical Engineering and Materials Science Practice, 2021-2023
- Adjunct Lecturer, 2014 – 2021
- Graduate Research Assistant for McGill Composites Center, 2007 – 2012
- AME Teaching Assistant for Mechanics Behavior of Materials, and Fluid Dynamics, 2006-2008

University of Southern California, Irvine, California

- Undergraduate Research Assistant for UCI Combustion Laboratory, 2005 – 2006

Continuing Education

- **NAFEMS eLearning Course (eL632)** – Fatigue & Fracture Mechanics in FEA 2026
- **ASM Conference** – FAS Summit on Failure Analysis & Prevention: Fatigue and Fracture 2026
- **CAMX** – Fractography of Composites (Presenter) 2022

- **ASM Webinar** – Introduction to the Metallurgy of Precipitation Hardening S.S. 2020
- **ASM Webinar** – Grain Size: Then and Now 2022
- **ASM Webinar** – Weld Metallography and Microstructure 2022
- **NAFE** – Conference attendee and Presenter 2019, 2020

Professional Affiliations

ASM

- Technical Reviewer for journal article submissions, Journal of Failure Analysis and Prevention
- Member, ASM International

National Academy of Forensic Engineers

- Board Certified Diplomate in Forensic Engineering, by National Academy of Forensic Engineers
- Technical Reviewer for journal article submissions

National Society of Professional Engineers

- Member, National Society of Professional Engineers

The American Society of Mechanical Engineers

- Member, The American Society of Mechanical Engineers

ASTM International

- Member, ASTM International

Independent Metallurgical Engineering Consultants of California (IMECA)

- Member

Project Experience

Power Generation

Overhead Conductor Cable Failure

- A power utility line failed at a residential home and was part of evidence collected after a residential fire. A materials failure analysis of the conductor cables indicated locations of arcing and melting at various areas along the cable length. The work involved microscopic and metallographic examination of the arc bead microstructure to understand and provide opinions on the cause of the arcing and melting damage.

Industrial Equipment

Concrete Boom Accident

- A concrete boom buckled during operation and caused personal injury to a construction worker. A metallurgical failure analysis revealed that the boom buckled and separated along fillet welds that showed evidence of corrosion assisted fatigue, in weld cracks that existed prior to the accident taking place.

Industrial Equipment

Metal Bellows Expansion Joint

- A leak before break condition was identified on a metal bellows expansion joint after 5 years in service. A partial circumferential crack was identified, originating at the crest of a convolution at a butt weld. The fracture surface indicated random fan like fatigue striations, an indication of flow induced vibration and a resonance condition.

Automotive

Cast Iron Fly Wheel Brittle Fracture

- An aftermarket cast iron flywheel abruptly shattered in a restored mid-sixties muscle car. The shrapnel caused personal injury to a bystander. A metallurgical and mechanical failure analysis investigation revealed that the flywheel material had microstructural deficiencies, casting defects and substandard mechanical properties that did not meet the OEM flywheel material specifications.

Aviation

Helicopter Accident

- A helicopter accident occurred because of the inversion of the helicopter during an emergency landing. An examination of the mechanical floatation system, cabling and handle activation was investigated.

Consumer Product

Road Bicycle Handlebar Stem Failure

- The handlebar stem from a road bike separated during use resulting in a bicycle accident. A materials failure analysis of the handlebar stem was performed. Optical and scanning electron microscope examinations revealed that the forged Aluminum stem experienced a fatigue crack around the attachment bolts.

Publications

- "The Complementary Use of 3D X-Ray Micro-Computed Tomography with Traditional Metallography," N.K. Kar and A. Bovie and T. Roig, Advanced Materials & Processes, Vol. 180, No. 1, pp. 16–20, January 01, 2022.
- "Metallurgical and Mechanical Failure Analysis of an Aftermarket Flywheel," N.K. Kar and J. Kar, Journal of the National Academy of Forensic Engineers, Vol. 37, No. 1, pp. 16, December 2020.
- "Failure Analysis of a Composite Rudder Stock using 3D X-Ray Microcomputed Tomography," N.K. Kar and A. Bovie, Journal of Failure Analysis and Prevention, Vol. 19, No. 1, pp. 24–28, 2019.
- "Metallurgical and Materials PE Exam Solved Problems," N.K. Kar, Y. Hu, and L. Grunenfelder, PPI Publications, pp. [114 pages], May 11, 2017.
- "Failure Analysis of a Ti6Al4V Used in a RASL Procedure," N.K. Kar, T. Roig, J. Kar, and Y. Hu, Journal of Failure Analysis and Prevention, Vol. 16, No. 3, pp. 482–488, April 29, 2016.
- "Failure Analysis of a Polymer Centrifugal Impeller," N.K. Kar, Y. Hu, N. Kar, and R. Kar, Case Studies in Engineering Failure Analysis, Vol. 4, No. [Not Specified], pp. 1–7, April 17, 2015.
- "Transverse Compression Failure of Unidirectional Composites," Y. Hu, N.K. Kar, and S. Nutt, Polymer Composites, Vol. 36, No. 4, pp. 756–766, April 2015.
- "Tension-tension Fatigue Behavior of Layer-to-Layer 3-D Angle-Interlock Woven Composites," L. Jin, B. Jin, N.K. Kar, S. Nutt, B. Sun, and B. Gu, Materials Chemistry and Physics, Vol. 140, No. 1–3, pp. 183–190, June 1, 2013.
- "Diametral Compression of Pultruded Composite Rods," N.K. Kar, Y. Hu, B. Ahn, and S.R. Nutt, Composites Science and Technology, Vol. 72, No. 11, pp. 1283–1290, May 11, 2012.
- "Effect of Filler on Thermal Aging of Composites for Next-Generation Power Lines," E. Barjasteh, N.K. Kar, and S.R. Nutt, Composites Part A, Vol. 42, No. 12, pp. 1873–1882, 2011.
- "Tension–tension fatigue of hybrid composite rods," N.K. Kar and Y. Hu, Composites Part B: Engineering, Vol. 43, No. 5, pp. 2115–2124, July 2012.
- "Bending fatigue of hybrid composite rods," Kar N.K., Hu Y., Ahn B., and Nutt S.R., Composites Part A: Applied Science and Manufacturing, Vol. 42, No.3, pp. 328–336. March 2011.

Presentations

- "Save that part! Using industrial CT, SEM, and Microscopy to Improve Composite Materials," A.G. Bovie, **N. K. Kar**, CAMX – The Composites and Advanced Materials Expo, Anaheim, California. 2022, October.
- "Metallurgical and Mechanical Failure Analysis of an Aftermarket Flywheel," **N.K. Kar**, National Academy of Forensic Engineers (NAFE), San Diego, 2019, January.