

Ruobing Bai

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EDUCATION

Ph.D., Engineering Sciences 2018
Harvard University
Thesis: “Fatigue of Hydrogels”
Advisor: Zhigang Suo

B.S., Theoretical and Applied Mechanics 2012
Peking University
Thesis: “Stress Analysis of Lithium Ion Batteries with Surface Effect and Phase Transition”
Advisor: Huiling Duan

ACADEMIC POSITIONS

Assistant Professor Jan 2021 - Now
Northeastern University, Department of Mechanical and Industrial Engineering

Postdoctoral Fellow Aug 2018 - Dec 2020
California Institute of Technology, Department of Mechanical and Civil Engineering
Advisor: Kaushik Bhattacharya

Postdoctoral Fellow May 2018 - Aug 2018
Graduate Research Assistant Sept 2012 - May 2018
Harvard University, John A. Paulson School of Engineering and Applied Sciences
Advisor: Zhigang Suo

RESEARCH INTERESTS

- Solid mechanics and large deformation
- Damage, fracture, fatigue, debonding, strengthening, toughening, and adhesion
- Stimuli-responsive actuation and instability
- Soft active materials and sustainable materials
- Multi-physics of materials: mechanics, thermodynamics, chemistry, optics, and electromagnetism

JOURNAL PUBLICATIONS

1. Y. Xiao, Q. Li, X. Yao, R. Bai, W. Hong, C. Yang, “Fatigue of Amorphous Hydrogels with Dynamic Covalent Bonds”. *Extreme Mechanics Letters*, 2022.
2. Z. Wei, R. Bai, “Temperature-Modulated Photomechanical Actuation of Photoactive Liquid Crystal Elastomers,” *Extreme Mechanics Letters*, 2022.
3. R. Bai, E. Ocegueda, K. Bhattacharya, “Photochemical-Induced Phase Transitions in Photoactive Semicrystalline Polymers”. *Physical Review E*, 2021.
4. M. Hua, C. Kim, Y. Du, D. Wu, R. Bai, X. He, “Swaying Gel: Chemo-mechanical Self-Oscillation Based on Dynamic Buckling”. *Matter*, 2021.
5. R. Bai, Y. S. Teh, K. Bhattacharya, “Collective Behavior in the Kinetics and Equilibrium of Solid-State Photoreaction”. *Extreme Mechanics Letters*, 2021.
6. R. Bai, K. Bhattacharya, “Photomechanical Coupling in Photoactive Nematic Elastomers”. *Journal of the Mechanics and Physics of Solids*, 2020.

7. J. Yang, J. Steck, R. Bai, Z. Suo, “Topological Adhesion II. Stretchable Adhesion”. *Extreme Mechanics Letters*, 2020.
8. B. Chen, J. Yang, R. Bai, Z. Suo, “Molecular Staples for Tough and Stretchable Adhesion in Integrated Soft Materials”. *Advanced Healthcare Materials*, 2019.
9. J. Yang, R. Bai, J. Li, C. Yang, X. Yao, Q. Liu, J. Vlassak, D. J. Mooney, Z. Suo, “Design Molecular Topology for Wet-Dry Adhesion”. *ACS Applied Materials & Interfaces*, 2019.
10. J. Yang, R. Bai, B. Chen, Z. Suo, “Hydrogel Adhesion: A Supramolecular Synergy of Chemistry, Topology, and Mechanics”. *Advanced Functional Materials*, 2019.
11. R. Bai, J. Yang, X. P. Morelle, Z. Suo, “Flaw-Insensitive Hydrogels under Static and Cyclic Loads”. *Macromolecular Rapid Communications*, 2019.
12. R. Bai, B. Chen, J. Yang, Z. Suo, “Tearing a Hydrogel of Complex Rheology”. *Journal of the Mechanics and Physics of Solids*, 2019.
13. R. Bai, J. Yang, Z. Suo, “Fatigue of Hydrogels”. *European Journal of Mechanics - A/Solids*, 2019.
14. M. Sun, R. Bai, X. Yang, J. Song, Z. Suo, X. He, “Hydrogel Interferometry for Ultrasensitive and Highly Selective Chemical Detection”. *Advanced Materials*, 2018.
15. X. P. Morelle, W. R. Illeperuma, K. Tian, R. Bai, Z. Suo, J. Vlassak, “Highly Stretchable and Tough Hydrogels Below Water Freezing Temperature”. *Advanced Materials*, 2018.
16. Z. Wang, J. Tang, R. Bai, W. Zhang, T. Lian, T. Lu, T. Wang, “A Phenomenological Model for Shakedown of Tough Hydrogels under Cyclic Loads”. *Journal of Applied Mechanics*, 2018.
17. J. Yang, R. Bai, Z. Suo, “Topological Adhesion of Wet Materials”. *Advanced Materials*, 2018.
18. E. Zhang, R. Bai, X. P. Morelle, Z. Suo, “Fatigue Fracture of Nearly Elastic Hydrogels”. *Soft Matter*, 2018.
19. M. Qin, M. Sun, R. Bai, Y. Mao, X. Qian, D. Sikka, Y. Zhao, H. J. Qi, Z. Suo, X. He, “Bioinspired Hydrogel Interferometer for Adaptive Coloration and Chemical Sensing”. *Advanced Materials*, 2018.
20. R. Bai, J. Yang, X. P. Morelle, C. Yang, Z. Suo, “Fatigue Fracture of Self-Recovery Hydrogels”. *ACS Macro Letters*, 2018.
21. X. P. Morelle, R. Bai, Z. Suo, “Localized Deformation in Plastic Liquids on Elastomers”. *Journal of Applied Mechanics*, 2017.
22. R. Bai, Q. Yang, J. Tang, X. P. Morelle, J. Vlassak, Z. Suo, “Fatigue Fracture of Tough Hydrogels”. *Extreme Mechanics Letters*, 2017.
23. R. Bai, Z. Suo, “Optomechanics of Soft Materials”. *Journal of Applied Mechanics*, 2015.
24. Y. Liu, P. Lv, J. Ma, R. Bai, H. L. Duan, “Stress Fields in Hollow Core–Shell Spherical Electrodes of Lithium Ion Batteries”. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Science*, 2014.

PATENTS

1. Jiawei Yang, Ruobing Bai, Zhigang Suo, “Topological Adhesion of Materials”. US Patent App. 17/048,803, 2021.

GRANTS

- *Strong, Tough, Durable, and Degradable Bio-Fabricated Materials*, Northeastern University FY23 TIER 1 Grant, 2022, \$50,000 (role: co-PI with Prof. Neel Joshi)
- *Mesoscale Photomechanical Coupling in Photoactive Liquid Crystal Elastomers*, National Science Foundation (NSF), 2022, \$339,246 (role: single PI)

AWARDS AND HONORS

- *Haythornthwaite Research Initiation Award*
Applied Mechanics Division of American Society of Mechanical Engineers (ASME) 2022
- *Best Poster Award*
New England Workshop on the Mechanics of Materials and Structures, Massachusetts Institute of Technology, Cambridge, MA 2017
- *Haythornthwaite Student Travel Grants*

- American Society of Mechanical Engineers International Mechanical Engineering Congress & Exposition, Phoenix, AZ 2016
- *Chun-Tsung Scholar*
Peking University, Beijing, China 2010
- *National Scholarship of China*
Peking University, Beijing, China 2009
- *Pacemaker to Merit Student*
Peking University, Beijing, China 2009

PRESENTATIONS

Invited Seminars and Keynote Presentations

- *Mesoscale Photomechanical Coupling in Photoactive Materials*
New England Workshop on the Mechanics of Materials and Structures (NEW MECH), MIT, Cambridge, MA May 2022
- *Fatigue of Hydrogels and What We Have Learned So Far*
Prospects of Soft Matter Symposium, CU Boulder, virtual April 2022
- *Liquid Crystal Elastomers: from Optics to Novel Mechanics*
Display Materials Technology Symposium, KLA Instruments, virtual Feb 2022
- *Mesoscale Photomechanical Coupling in Photoactive Materials*
Engineering and Applied Science Forum Webinar, virtual Jan 2022
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*
California Institute of Technology, Pasadena, CA May 2020
- *Soft Active Materials towards Soft Machines: Characterization, Design, and Functionalization*
University of Houston, Houston, TX Feb 2020
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*
Southern Methodist University, Dallas, TX Feb 2020
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*
Northeastern University, Boston, MA Feb 2020
- *Mechanics of Soft Active Materials: Characterization, Design, and Functionalization*
University at Buffalo, Buffalo, NY Nov 2019

Conference Presentations

- *National Congress for Theoretical and Applied Mechanics (USNC-TAM): 2022* (Austin, TX), 2018 (Chicago, IL)
- *Society of Engineering Science (SES): 2019* (St. Louis, MO)
- *Materials Research Society (MRS) Fall: 2019* (Boston, MA)
- *International Mechanical Engineering Congress & Exposition (ASME-IMECE): 2021* (virtual), 2016 (Phoenix, AZ)
- *New England Workshop on the Mechanics of Materials and Structures (NEW MECH): 2017* (MIT, Cambridge, MA)

COURSES

Undergraduate Courses

- ME2355, *Mechanics of Materials*, Instructor, Northeastern University Fall 2022
- ME2340/2341, *Introduction to Materials Science*, Instructor, Northeastern University Spring 2021, 2022
- ES 181, *Engineering Thermodynamics*, Teaching Fellow, Harvard University Fall 2015
- ES 120, *Introduction to the Mechanics of Solids*, Teaching Fellow, Harvard University Spring 2015

Graduate Courses

- AM/ME 165, *Finite Elasticity*, Guest Lecturer, California Institute of Technology Winter 2019
- ES 240, *Solid Mechanics*, Teaching Fellow, Harvard University Fall 2013

ACADEMIC SERVICES

- **Moderator:** iMechanica, world's largest web of mechanics and mechanicians
- **Discussion leader:** iMechanica Journal Club, March 2019, *Fatigue of hydrogels*
- **Guest editor:** *Frontiers in Robotics and AI* - Soft Robotics, Research Topic *Extreme Mechanics of Soft Active Materials for Soft Robotics*
- **Conference chair:** Minisymposium, *Mechanics of Liquid Crystal Elastomers*, 19th U.S. National Congress on Theoretical and Applied Mechanics (USNC/TAM), 2022, UT Austin
- **Session chair:** IUTAM (International Union of Theoretical and Applied Mechanics) Symposium, *Mechanics of Smart and Tough Gels*, 2021, UT Austin
- **Reviewer:** *ACS Macro Letters, Advanced Materials, Advanced Functional Materials, Applied Physics Letters, Engineering Fracture Mechanics, European Journal of Mechanics / A Solids, European Polymer Journal, Extreme Mechanics Letters, International Journal of Solids and Structures, iScience, Journal of Applied Mechanics, Journal of the Mechanics and Physics of Solids, Macromolecules, Materials Science & Engineering C, Materials Today, Materials Today Bio, Mechanics of Materials, Mechanics of Soft Materials, Molecules, Nano Letters, npj Computational Materials, Proceedings of the Royal Society A, Physical Review Applied, Physical Review E, Physical Review Letters, Physical Review Materials, Physical Review X, PNAS, RSC Advances, Science Advances, Soft Matter*