

Baoxing Xu

Associate Professor

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EMPLOYMENT

Associate Professor (with tenure)	07/2020-Present
Assistant Professor	08/2014-07/2020

Department of Mechanical and Aerospace Engineering
University of Virginia

EDUCATION

Beckman Postdoctoral Fellow, Beckman Institute University of Illinois at Urbana-Champaign Advisor: Professor John A Rogers (now at Northwestern University)	08/2012-08/2014
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PhD in Mechanics and Materials, Columbia University Dissertation: "Science of Nanofluidics and Energy Conversion" Advisor: Professor Xi Chen	10/2012
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MS in Solid Mechanics, Northwestern Polytechnical University Thesis: "Indentation Fatigue Behavior of Polycrystalline Cooper" Advisor: Professor Zhufeng Yue	04/2007
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BS in Engineering Mechanics, Northwestern Polytechnical University	07/2004
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RESEARCH INTERESTS

Our research interests are focused on multiscale/multiphysics mechanics of materials and its-driven extreme design and nanomanufacturing of functional structures and devices for applications in wearable electronics and healthcare, in particular, soft-hard material integration, porous structures, solid-liquid functionalized materials, and bioinspired flexible devices and structures.

We also are working on nanomechanics at extreme conditions, including mechanics of liquids in nanoconfinements, nanofluidics in response to environments, and thermal transport of mechanically deformed nanomaterials.

SELECTED AWARDS & HONORS

Young Investigator Medal, Society of Engineering Science (SES) (awarded to a promising early-career researcher whose work has already had an impact in his/her field within the engineering sciences)	2023
Participant of China-America Frontiers of Engineering Symposium (CAFOE), US National Academy of Engineering (NAE)	2022
Sia Nemat-Nasser Early Career Award, ASME (for recognizing early career research excellence in the areas of experimental, computational, and theoretical mechanics and materials by young investigators who are within 10 years after their Ph.D. degree)	2020
Young Investigator Program (YIP) Award, Office of Naval Research (only 25 scientists selected nationwide)	2020
Beckman Postdoctoral Fellowship, University of Illinois at Urbana-Champaign (The Arnold and Mabel Beckman Foundation established this program in 1991 to recruit outstanding recent Ph.D. recipients or students in their final year of doctoral study to work at the Beckman Institute. Four to six fellows are selected annually for terms of up to three years.)	2012
NSF Travel Grant Award for ASME IMECE Micro/Nano Poster Forum	2011
NSF Travel Grant Award for CMMI Research and Innovation Conference	2010
Boeing Graduate Fellowship at Columbia University, Boeing Company	2008
Best Thesis for Master Degree, Northwestern Polytechnical University	2008
Best Student Graduate Award, Shaanxi Province	2007
Top 10 Researchers in 2006, Northwestern Polytechnical University (all other 9 awardees were full professor)	2007
Outstanding Scholarship, China Baosteel Education Foundation (only 30 students awarded including both graduate and undergraduate students in China in 2006, Rank: 8/30)	2006
National Scholarship (1st Prize), Ministry of Education of China	2002

SELECTED PUBLICATIONS (* group student, ^ corresponding author)

90+ peer reviewed papers in journals including PNAS, JMPS (flagship journal in my field), IJSS, EML, JAM, MRC (IJSS, EML, JAM and MRC are important journals in my field), Matter, Nature Communications, Advanced Materials, ACS Nano, Advanced Functional Materials, Advanced Healthcare Materials, Nano letters, Nano Energy, Energy & Environmental Science, Applied Mechanics Review, PRL, APL, Proceedings of the Royal Society, Acta Materialia, and Scripta Materialia.

2 invited *perspective* papers (1 EML, 1 MRC)

Full list of papers: <https://xugroup.weebly.com/publications.html>

A. Perspectives (invited)

- [1]. **Baoxing Xu**[^]. A Perspective on Intelligent Design of Engineered Materials and Structures by Interface Mechanics. *Mechanics Research Communications*. 119(2022) 103668.
- [2]. **Baoxing Xu**[^], John A Rogers. Mechanics-Driven Approaches to Manufacturing—A Perspective. *Extreme Mechanics Letters*. 7(2016)44-48.

B. Achieved Journals

- [1]. Haozhe Zhang*, Weizhu Yang, Qingchang Liu*, Yuan Gao*, Zhufeng Yue, **Baoxing Xu**[^]. Mechanical Janus Structures by Soft-Hard Material Integration. *Advanced Materials*
- [2]. Yue Zhang*, **Baoxing Xu**[^]. Electro-chemo-mechanics theory in transfer printing of thin films in electrolyte solutions. *International Journal of Solids and Structures (IJSS)*. 254-255(2022)111848
- [3]. Yuan Gao*, Mentian Yin*, Haozhe Zhang*, **Baoxing Xu**[^]. Electrically Suppressed Outflow of Confined Liquid in Hydrophobic Nanopores. *ACS Nano* 16(2022)9420-9427
- [4]. Haozhe Zhang*, **Baoxing Xu**[^]. Soft-hard material integration enabled programmable robotic locomotion. *Applied Physics Letters* 121(2022)214104
- [5]. Tao Wang#, Qingchang Liu*#, Haitao Liu, **Baoxing Xu**[^], Hangxun Xu. Printable and Highly Stretchable Viscoelastic Conductors with Kinematically Reconstructed Conductive Pathways. *Advanced Materials*. (# Equal contribution) 34(2022)2202418
- [6]. Yuan Gao*, Mingzhe Li, Yue Zhang*, Haozhe Zhang*, Weiyi Lu, **Baoxing Xu**[^]. Anomalous

solid-like necking of confined water outflow in hydrophobic nanopores. *Matter*. 5(2022)266-280

- [7]. Aisha Okmi#, Xuemei Xiao#*, Yue Zhang*, Rui He, Olugbenga Olunloyo, Sumner B. Harris, Tara Jabegu, Ningxin Li, Diren Maraba, Yasmeeen Sherif, Ondrej Dyck, Ivan Vlassiouk, Kai Xiao, Pei Dong^, **Baoxing Xu**^, Sidong Lei. Discovery of Graphene-Water Membrane Structure: Toward High-Quality Graphene Process. *Advanced Science*. (# Equal contribution)
- [8]. Mingyu Sang#, Kyowon Kang#, Yue Zhang#*, Haozhe Zhang*, Kiho Kim, Myeongki Cho, Jongwoon Shin, Jung-Hoon Hong, Taemin Kim, Shin Kyu Lee, Woon-Hong Yeo, Jung Woo Lee, Taeyoon Lee, **Baoxing Xu**^ and Ki Jun Yu. Ultra-high Sensitive Au-doped Silicon Nanomembrane Based Wearable Sensor Arrays for Continuous Skin Temperature Monitoring with High Precision. *Advanced Materials*. 34(2022) 2105865 (# Equal contribution)
- [9]. Mengtian Yin*, Zachary Alexander Kim, **Baoxing Xu**^. Micro/Nanofluidic-Enabled Biomedical Devices: Integration of Structural Design and Manufacturing. *Advanced NanoBiomed Research*. 2(2022) 2100117.
- [10]. Qingchang Liu*, **Baoxing Xu**^. Anomalous Thermal Transport of Mechanically Bent Graphene: Implications for Thermal Management in Flexible Electronics. *ACS Applied Nano Materials* 5(2022) 13180-13186.
- [11]. Mengtian Yin*, Wanqing Xie, Li Xiao, Sun-Sang J.Sung, Mingyang Ma, Li Jin, Xudong Li, **Baoxing Xu**^. Cyclic swelling enabled, electrically conductive 3D porous structures for microfluidic urinalysis devices. *Extreme Mechanics Letters*. 52(2022)101631
- [12]. Junkyu Park, Yue Zhang*, **Baoxing Xu**, Seok Kim. Pattern transfer of large-scale thin membranes with controllable self-delamination interface for integrated functional systems. *Nature Communications*. 12 (2021)6882
- [13]. Qingchang Liu*, Yuan Gao*, **Baoxing Xu**^. Transferable, Deep Learning-driven Fast Prediction and Design of Thermal Transport in Mechanically Stretched Graphene Flakes. *ACS Nano*. 15(2021)16597-16606
- [14]. Kyunghun Kim#, Ho Joong Kim#, Haozhe Zhang*#, Woohyun Park, Dawn Meyer, Min Ku Kim, Bongjoong Kim, Heun Park, **Baoxing Xu**^, Pete Kollbaum^, Bryan W Boudouris^, Chi Hwan Lee^. All-printed stretchable corneal sensor on soft contact lenses for noninvasive and painless ocular electrodiagnosis. *Nature Communications* 12 (2021) 1544 (#Equal contribution)
- [15]. Shifeng Nian, Jinchang Zhu, Haozhe Zhang*, Zihao Gong, Guillaume Freychet, Mikhail Zhernenkov, **Baoxing Xu**^, Li-Heng Cai. Three-Dimensional Printable, Extremely Soft, Stretchable, and Reversible Elastomers from Molecular Architecture-Directed Assembly.

- [16]. Stephanie M Guthrie#, Yuan Gao#*, Kevin H Stone, **Baoxing Xu**[^], Gaurav Giri[^]. Probing Molecular Assembly of Small Organic Molecules during Meniscus-Guided Coating Using Experimental and Molecular Dynamics Approaches. *The Journal of Physical Chemistry C*. 125(2021)6269-6277(# Equal contribution)
- [17]. Elham Easy, Yuan Gao*, Yingtao Wang, Dingkai Yan, Seyed M Goushehgir, Eui-Hyeok Yang, **Baoxing Xu**[^], Xian Zhang[^]. Experimental and Computational Investigation of Layer-Dependent Thermal Conductivities and Interfacial Thermal Conductance of One- to Three-Layer WSe₂. *ACS Applied Materials & Interfaces*. 13(2021) 13063-13071
- [18]. Yuan Gao*, Mingzhe Li, Yue Zhang*, Weiyi Lu, **Baoxing Xu**[^]. Spontaneous Outflow Efficiency of Confined Liquid in Hydrophobic Nanopores. *Proceedings of the National Academy of Sciences (PNAS)*. 117(2020) 25246-25253.
- [19]. Yue Zhang*, Mengtian Yin*, Yongmin Baek, Kyusang Lee, Giovanni Zangari, Liheng Cai, **Baoxing Xu**[^]. Capillary Transfer of Soft Films. *Proceedings of the National Academy of Sciences (PNAS)*. 117(2020) 5210-5216
- [20]. Haozhe Zhang*, Weizhu Yang, **Baoxing Xu**[^]. Rotation Mechanics of Optical Scatters in Stretchable Metasurfaces. *International Journal of Solids and Structures*. 191-192(2020)566-576
- [21]. Qingchang Liu*, **Baoxing Xu**[^]. Solution Evaporation-Driven Crumpling and Assembling of Large-Accessible Space, High-Mechanical Strength Graphene/Carbon Nanotubes Composite Nanoparticles. *ACS Applied Materials & Interfaces*. 12(2020) 43058-43064
- [22]. Hyungjun Kim, Heung Soo Lee, Yale Jeon, Woohyun Park, Yue Zhang*, Bongjoong Kim, Hanmin Jang, **Baoxing Xu**, Yoon Yeo, Dong Rip Kim, Chi Hwan Lee. Bioresorbable, Miniaturized Porous Silicon Needles on Flexible Water-Soluble Backing for Unobtrusive, Sustained Delivery of Chemotherapy. *ACS Nano*. 14 (2020) 7227-7236.
- [23]. Qingchang Liu*, Jiaying Huang and **Baoxing Xu**[^]. Evaporation-driven Crumpling and Assembling of Two-Dimensional (2D) Materials: A Rotational Spring – Mechanical Slider Model. *Journal of the Mechanics and Physics of Solids*. 133(2019)103722 (34 pages)
- [24]. Mengtian Yin*, Li Xiao, Sung-Yun Kwon, Yi Zhang, Poonam R Sharma, Li Jin, Xudong Li and **Baoxing Xu**[^]. 3D Printed Microheater Sensor-Integrated, Drug-Encapsulated Microneedle Patch System for Pain Management. *Advanced Healthcare Materials* (2019) 1901170.
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Rotation Enables Soft-Hard Integrated Auxetic Mechanical Metamaterials. *Proceedings of the Royal Society A*. 475(2019)0234 (20 pages)

- [26]. Bongjoong Kim[†], Jiyeon Jeon[†], Yue Zhang^{†*}, Dae Seung Wie, Jehwan Hwang, Sang Jun Lee, Dennis E. Walker Jr., Don C. Abeysinghe, Augustine Urbas, **Baoxing Xu**[^], Zahyun Ku, Chi Hwan Lee. Integration of three dimensional (3D) plasmonic nanoarrays with arbitrary substrate materials and structures. ([†]Equal contribution). *Nano Letters*. 19(2019)5796-5805
- [27]. Yue Zhang*, Bongjoong Kim, Yuan Gao*, Dae Seung Wie, Chi Hwan Lee, **Baoxing Xu**[^]. Mechanics of Transfer Printing of Thin Films in a Liquid Environment. *International Journal of Solids and Structures (IJSS)*. 180-181(2019)30-44
- [28]. Yuan Gao*, Yue Zhang*, **Baoxing Xu**[^]. Confined Water-Assistant Thermal Response of Graphene-Oxide Heterostructure and Its Enabled Mechanical Sensors for Load Sensing and Mode Differentiation. *ACS Applied Materials & Interfaces*. 11(2019)19596-19604.
- [29]. Xu Wang, Qingchang Liu*, Siyao Wu, **Baoxing Xu**, and Hangxun Xu. Multilayer Polypyrrole Nanosheets with Self-Organized Surface Structures for Flexible and Efficient Solar-Thermal Energy Conversion. *Advanced Materials*. 31(2019)1807716.
- [30]. Liu Wang[#], Yuan Gao^{#*}, Fanqi Dai, Deying Kong, Huachun Wang, Pengcheng Sun, Zhao Shi, Xing Sheng, **Baoxing Xu**[^] and Lan Yin. Geometrical and Chemical Dependent Hydrolysis Mechanisms of Silicon Nanomembranes for Biodegradable Electronics. ([#]Equal contribution). *ACS Applied Materials & Interfaces*. 11(2019)18013-18023
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- [34]. Yue Zhang*, Mingzhe Li, Yuan Gao, **Baoxing Xu**[^], Weiyi Lu. Compressing Liquid Nanofoam System: Liquid Infiltration or Nanopore Deformation? *Nanoscale*. 10(2018)18444-18450.
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Hollow Amorphous Carbon Nanospheres: In-situ Experiment and Theoretical Analysis. *Carbon*. 137(2018)411-418.

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C. Book Chapter (invited)

- [1]. **Baoxing Xu**, Xi Chen, Zhufeng Yue. Indentation Fatigue Mechanics. *Handbook of Nonlocal Continuum Mechanics for Materials and Structures*. Editor: George Z. Voyiadjis. Springer Nature Publisher. 2018. pp: 1-31.

D. Editorial

- [1]. **Baoxing Xu**, Xiaodong Chris Li, Horacio D Espinosa. Editorial for the focus issue on “Mechanics in Extreme Manufacturing” in Extreme Mechanics Letters. *Extreme Mechanics Letters*. 7(2016)42-43.