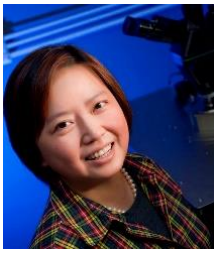
Xin Zhang, Ph.D.

Member of EASA; Fellow of ASME, IEEE, AIMBE, APS, Optica, AAAS, NAI, and Guggenheim

Distinguished Professor of Engineering
Professor, Mechanical Engineering
Professor, Electrical & Computer Engineering
Professor, Biomedical Engineering
Professor, Materials Science & Engineering

(617) 358-2702 | xinz@bu.edu
Research Site: https://people.bu.edu/xinz
Photonics Center, 8 St. Mary's Street
Boston University, Boston, MA
Citizenship: United States of America



Education and Training:

Postdoc, Electrical Engineering and Computer Science, Massachusetts Institute of Technology (MIT)
Ph.D., Mechanical Engineering, Hong Kong University of Science and Technology (HKUST)

Positions and Employment:

2011 – present	Professor, College of Engineering[1], Boston University
2006 – 2011	Associate Professor, College of Engineering, Boston University
2002 – 2006	Assistant Professor, College of Engineering, Boston University
2000 – 2001	Research Scientist, Electrical Engineering and Computer Science, MIT

Other Positions:

2020 – present	Co-Founder and Chief Technology Officer, Acoulent LLC
2018 – present	Co-Founder and Chief Technology Officer, Primetaz LLC
2016 – present	Associate Director, Nanotechnology Innovation Center (BUnano)
2015 – present	Director, NSF Research Experiences for Teachers (RET Site)
2015 – present	Director, NSF Research Experiences for Undergraduates (REU Site)
2008 – 2011	Associate Chair, Department of Mechanical Engineering, Boston University

Major Honors/Awards/Special Recognitions:

- **ASME Robert Henry Thurston Lecture Award (2024)**
  Established in 1925 to honor ASME's inaugural president, the Robert Henry Thurston Lecture provides an esteemed platform for a leader in pure and/or applied science and engineering to present to the Society, delving into topics of broad interest, resonating profoundly within the engineering community.
- **Honoree of Fast Company Innovation by Design Awards (2024)**
  Recognized in the materials category, which "honors material innovations that lead to greener, better products". "We seek projects and ideas with a spark of ingenuity—something that solves a problem, improves a product, or pushes people, companies, and industries to be better versions of themselves".
- **Finalist of the Falling Walls Science Breakthroughs of the Year (2023 & 2024)**
  "These outstanding breakthroughs will change the face of the world and impressively prove what ingenuity, curiosity and courage can achieve".
- **Member of the European Academy of Sciences and Arts (2023)**
  "Members are elected for outstanding achievements in science, arts and governance, and their exceptional standing in society as a result of their scientific work, publications or leadership".
- **Finalist of IET Excellence and Innovation Awards – International Award (2023)**
  "The IET Excellence and Innovation Awards shine a spotlight on the ground-breaking innovations and best practices in engineering, science and technology, and the fantastic trailblazers who are changing the course of our future".
- **Sigma Xi Walston Chubb Award for Innovation (2023)**
  The Walston Chubb Award for Innovation, presented by Sigma Xi, The Scientific Research Honor Society, celebrates pioneering research endeavors that venture into new scientific territories, provide inventive solutions to enduring scientific or engineering dilemmas, or introduce methodologies poised to shape the scientific or engineering landscape.

[1] *Appointments in Mechanical Engineering, Electrical & Computer Engineering, Biomedical Engineering, Materials Science and Engineering and the Photonics Center at Boston University.*

- **IEEE EMBS Technical Achievement Award (2023)**
  The IEEE EMBS Technical Achievement Award is a prestigious accolade presented by the IEEE Engineering in Medicine and Biology Society (EMBS) to recognize significant contributions and innovations in the field of biomedical engineering.

- **ASME Per Bruel Gold Medal (2023)**
  The Per Bruel Gold Medal honors individuals who have demonstrated exceptional accomplishments and outstanding merit in the realm of noise control and acoustics. This recognition requires a demonstrable application of noise control and acoustics principles to significantly advance the art and science of mechanical engineering.

- **STAT Madness All-Star Award (2023)**
  Annually, STAT Madness, sponsored by STAT News, a prominent health media outlet within the Boston Globe Media network, aims to recognize and celebrate the most groundbreaking innovations in the fields of science and medicine.

- **Finalist of E&T Innovation Awards - Chief Engineer of the Year (2022)**
  This award recognizes chief engineers and innovators who have "demonstrated excellence in engineering and technology innovation as well as leadership".

- **Guggenheim Fellowship (2022)**
  The Guggenheim Fellowship, awarded by the John Simon Guggenheim Memorial Foundation, recognizes individuals with exceptional scholarly productivity or outstanding creative talent in the arts, supporting exceptional individuals in their pursuit of scholarship in any field of knowledge and creation in any art form, under the freest possible conditions.

- **Distinguished Professor of Engineering (2022)**
  The Distinguished Professor of Engineering title at Boston University is conferred upon individuals with an extensive and distinguished record of impactful research and service to their profession. This prestigious title is held throughout their career at the university, acknowledging their enduring contributions to the field of engineering.

- **Rajen Kilachand Award for Integrated Life Science and Engineering (2021)**
  The Rajen Kilachand Fund for Integrated Life Science and Engineering acknowledges exemplary interdisciplinary research and pioneering solutions aimed at addressing pressing societal challenges and medical ailments.

- **Finalist of E&T Innovation Awards (2020 & 2021)**
  Excellence in R&D (2020), Digital Health and Social Care (2021), Tech for Good (2021)
  The E&T Innovation Awards, which "recognize and celebrate the very best new innovations across the breadth of science, engineering and technology".

- ***Invented Here!* Honoree (2020 & 2021)**
  Chosen by Boston Patent Law Association for patents "Apparatus for improving magnetic resonance imaging" and "Air-transparent selective sound silencer using ultra-open metamaterial".

- **Finalist of IET Achievement Medal (2020)**
  Finalist for the IET Achievement Medal for "major and distinguished contributions in various sectors of engineering and technology".

- **Fellow of National Academy of Inventors (2019)**
  This Fellow Program aims to "highlight academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society".

- **IET Innovation Award on Emerging Technology Design (2019)**
  The IET Innovation Awards recognize and celebrate "the most pioneering engineering and technology innovations from energy and sustainability to transport and healthcare."

- **Innovator of the Year Award (2018)**
  Bestowed annually by Boston University on a faculty member who "translates his/her world-class research into inventions and innovations that benefit humankind".

- **Charles DeLisi Award and Distinguished Lecture (2018)**
  The Charles DeLisi Award and Distinguished Lecture honors Boston University faculty "who have made outstanding contributions to engineering and society".
- **IEEE Sensors Council Technical Achievement Award (2016)**
  Conferred by the IEEE Sensors Council, this award recognizes individuals for notable contributions and advancements in the field of sensors and sensing technology throughout their career.
- **Inaugural Distinguished Faculty Fellow (2009)**
  An honor given to engineering faculty at Boston University "who is on a clear trajectory toward exemplary leadership career in all dimensions of science and engineering."
- **Fellow of APS** (American Physical Society, 2019)
- **Fellow of IEEE** (Institute of Electrical and Electronics Engineers, 2017)
- **Associate Fellow of AIAA** (American Institute of Aeronautics and Astronautics, 2017)
- **Fellow of AAAS** (American Association for the Advancement of Science, 2016)
- **Fellow of AIMBE** (American Institute for Medical and Biological Engineering, 2016)
- **Fellow of Optica** (formerly known as The Optical Society, 2016)
- **Fellow of ASME** (American Society of Mechanical Engineers, 2015)
- E.U.-U.S. National Academy of Engineering Invitee (ages: 30-45, 2011)
- National Academy of Engineering Invitee (ages: 30-45, 2007)

Recent Research and Innovation on Metamaterials at Boston University:

I. For clinical medical imaging technologies, including magnetic resonance imaging and ultrasound, in order to yield revolutionary increases in performance as well as disruptive new capabilities for diagnosis/therapy;

II. For acoustic silencing and noise reduction, making the world quieter by addressing long-standing noise issues in a wide range of mechanical systems, in which highly efficient, air-permeable sound silencers are required, such as fan, propeller, or engine noise reduction, as well as smart sound barriers, among many others;

III. With tunable and nonlinear responses for photonic and optical applications, to boost the development of next-generation (6G) terahertz communication and develop high-performance infrared and visible optical systems by providing high-end components, including emitters, detectors, filters, and lenses, among others.

Selected Recent Journal Papers (authored as Corresponding Author):

I.1. Boosting magnetic resonance imaging signal-to-noise ratio using magnetic metamaterials
G. Duan, X. Zhao, S.W. Anderson, **X. Zhang***
Communications Physics – Nature, 2019, 2: 35

I.2. Intelligent metamaterials based on nonlinearity for magnetic resonance imaging
X. Zhao, G. Duan, K. Wu, S.W. Anderson, **X. Zhang***
Advanced Materials, 2019, 31: 1905461

I.3. Nonreciprocal magnetic coupling using nonlinear meta-atoms
X. Zhao, K. Wu, C. Chen, T.G. Bifano, S.W. Anderson, **X. Zhang***
Advanced Science, 2020, 7: 2001443

I.4. Auxetics-inspired tunable metamaterials for magnetic resonance imaging
K. Wu, X. Zhao, T.G. Bifano, S.W. Anderson, **X. Zhang***
Advanced Materials, 2022, 34: 2109032

I.5. Helmholtz coil-inspired volumetric wireless resonator for magnetic resonance imaging
X. Zhu, K. Wu, S.W. Anderson, **X. Zhang***
Advanced Materials Technologies, 2023, 8: 2301053

I.6. Computational-design enabled wearable and tunable metamaterials via freeform auxetics for magnetic resonance imaging

K. Wu, X. Zhu, T.G. Bifano, S.W. Anderson, **X. Zhang***
Advanced Science, 2024, 11: 2400261

I.7. Wearable coaxially-shielded metamaterial for magnetic resonance imaging
X. Zhu, K. Wu, S.W. Anderson, **X. Zhang***
Advanced Materials, 2024, 36: 2313692

I.8. Wireless, customizable coaxially shielded coils for magnetic resonance imaging
K. Wu, X. Zhu, S.W. Anderson, **X. Zhang***
Science Advances, 2024, 10: eadn5195

I.9. Metamaterial-enhanced near-field readout platform for passive microsensor tags
K. Wu, G. Duan, X. Zhao, C. Chen, S.W. Anderson, **X. Zhang***
Microsystems & Nanoengineering – Nature, 2022, 8: 28

I.10. A robust near-field body area network based on coaxially-shielded textile metamaterial
X. Zhu, K. Wu, X. Xie, S.W. Anderson, **X. Zhang***
Nature Communications, 2024, 15: 6569

II.1. Horn-like space-coiling metamaterials toward simultaneous phase and amplitude modulation
R. Ghaffarivardavagh, J. Nikolajczyk, R.G. Holt, S. Anderson, **X. Zhang***
Nature Communications, 2018, 9: 1349

II.2. Ultra-open acoustic metamaterial silencer based on Fano-like interference
R. Ghaffarivardavagh, J. Nikolajczyk, S. Anderson, **X. Zhang***
Physical Review B, 2019, 99: 024302

II.3. Broadband labyrinthine acoustic insulator
A. Chen, X. Zhao, Z. Yang, S. Anderson, **X. Zhang***
Physical Review Applied, 2022, 18: 064057

II.4. Composite acoustic metamaterial for broadband low-frequency acoustic attenuation
A. Chen, Z. Yang, X. Zhao, S. Anderson, **X. Zhang***
Physical Review Applied, 2023, 20: 014011

II.5. Angle-variant metamaterial with reconfigurable phase modulation
A. Chen, Z. Yang, S.W. Anderson, **X. Zhang***
Physical Review Applied, 2024, 21: 014062

II.6. Two-sided acoustic modulator for broadband and individual control of reflected and transmitted sound waves
A. Chen, **X. Zhang***
Physical Review Applied, 2024, 22: 044010

III.1. Electromechanically tunable metasurface transmission waveplate at terahertz frequencies
X. Zhao, J. Schalch, J. Zhang, H.R. Seren, G. Duan, R.D. Averitt, **X. Zhang***
Optica, 2018, 5: 303-310

III.2. Optically modulated ultra-broadband all-silicon metamaterial terahertz absorbers
X. Zhao, Y. Wang, J. Schalch, G. Duan, K. Cremin, J. Zhang, C. Chen, R.D. Averitt, **X. Zhang***
ACS Photonics, 2019, 6: 830-837

III.3. Diatom frustule-inspired metamaterial absorbers: the effect of hierarchical pattern arrays
A. Li, X. Zhao, G. Duan, S.W. Anderson, **X. Zhang***
Advanced Functional Materials, 2019, 29: 1809029

III.4. Terahertz investigation of bound states in the continuum of metallic metasurfaces
X. Zhao, C. Chen, K. Kaj, I. Hammock, Y. Huang, R.D. Averitt, **X. Zhang***
Optica, 2020, 7: 1548-1554

III.5. Tunable toroidal response in a reconfigurable terahertz metamaterial
C. Chen, K. Kaj, Y. Huang, X. Zhao, R.D. Averitt, **X. Zhang***
Advanced Optical Materials, 2021, 9: 2101215

III.6. On-demand terahertz surface wave generation with microelectromechanical-system-based metasurface

C. Chen, K. Kaj, X. Zhao, Y. Huang, R.D. Averitt, **X. Zhang***
Optica, 2022, 9: 17-25

III.7. Broadband terahertz silicon membrane metasurface absorber
Y. Huang, K. Kaj, C. Chen, Z. Yang, S.R. Haque, Y. Zhang, X. Zhao, R.D. Averitt, **X. Zhang***
ACS Photonics , 2022, 9: 1078-1095

III.8. Tunable bound states in the continuum in a reconfigurable terahertz metamaterial
Y. Huang, K. Kaj, C. Chen, Z. Yang, R.D. Averitt, **X. Zhang***
Advanced Optical Materials, 2023, 11: 2300559

III.9. Diatom Cribellum-inspired hierarchical metamaterials: Unifying perfect absorption towards subwavelength color printing
X. Xie, Y. Huang, Z. Yang, A. Li, **X. Zhang***
Advanced Materials, 2024, 36: 2403304

Recent Notable Media Recognitions:

- Article: Custom-Tuned Materials
- Article: Making the World a Lot Quieter
  - YouTube: Ultra-Open Acoustic Metamaterial Silencer
  - Podcasts: No More Noise: Metamaterials Can Make the World a Quieter Place
- Article: Magnetic Metamaterial Can "Turn Up the Volume" of MRI
  - YouTube: Magnetic Metamaterial Can “Turn Up the Volume” of MRI
- Article: Speeding Up MRI Scans to Save Lives
  - YouTube: Speeding Up MRI Scans to Save Lives
- Article: This Bizarre Looking Helmet Can Create Better Brain Scans
  - YouTube: This Bizarre Looking Helmet Can Create Better Brain Scans
- Article: Unleashing the Power of Metamaterials to Improve MRI Imaging
- Article: Making MRI More Globally Accessible: How Metamaterials Offer Affordable, High-Impact Solutions

Principal Patents (as Lead Inventor):

- Air-transparent selective sound silencer using ultra-open metamaterial
- Phased array ultra open metamaterials for broadband acoustic silencing
- Apparatus for improving magnetic resonance imaging
- Nonlinear and smart metamaterials useful to change resonance frequencies

Publications Featured on Journal Covers:

Diatom Cribellum-inspired hierarchical metamaterials, *Advanced Materials* **36**(33), 2024.
Wearable coaxially-shielded metamaterial for magnetic resonance imaging, *Advanced Materials* **36**(31), 2024.
Computational-design enabled wearable and tunable metamaterials, *Advanced Science* **11**(26), 2024.
Steady-state monitoring of oxygen in a high-throughput organ-on-chip platform, *Analyst* **148**(15), 2023.
Auxetics-inspired tunable metamaterials for MRI, *Advanced Materials* **34**(6), 2021.
Tunable toroidal response in a reconfigurable metamaterial, *Advanced Optical Materials* **9**(22), 2021.
Nonreciprocal magnetic coupling using nonlinear meta-atoms, *Advanced Science* **7**(19), 2020.
Intelligent metamaterials for magnetic resonance imaging, *Advanced Materials* **31**(49), 2019.
Graphene nanofluids as thermal management materials, *ACS Applied Nano Materials* **2**(11), 2019.
Diatom frustule-inspired metamaterial absorbers, *Advanced Functional Materials* **29**(22), 2019.
Ultra-broadband all-silicon metamaterial absorbers, *ACS Photonics* **6**(4), 2019.

Silicon nanowires on *Coscinodiscus Species* diatom frustules, *Small* **14**(47), 2018.
Electromechanically tunable metasurface transmission waveplate, *Optica* **5**(3), 2018.
Voltage-tunable THz metamaterials, *Microsystems & Nanoengineering* **2**(3-4), 2016.
Tunable meta-liquid crystals, *Advanced Materials* **28**(8), 2016.
Terahertz field electron emission, *Applied Physics Letters* **107**(23), 2015.
Micro- and nano-lithography aided by unicellular algae, *Extreme Mechanics Letters* **4**, 2015.
3D terahertz metamaterials, *Journal of Micromechanics & Microengineering* **22**(4), 2012.
Metamaterial silk composites at terahertz frequencies, *Advanced Materials* **22**(32), 2010.

Research Highlights by Science and Nature:

Reconfigurable metasurfaces, *Science* **360**.
Metamaterials to see in THz, *Science* **334**.
Metamaterial Persian carpets, *Nature* **456**.
Near-perfect 'black', *Nature* **453**.
Filling the THz gap, *Science* **320**.

Honors/Awards at Boston University:

The Hariri Institute for Computing's Focused Research Program (2024)
Nanoscience & Nanotechnology Award (2006, 2008, 2009, 2013, 2014, 2015)
The Ignition Award (2018, 2020)
Technology Development Award (2004, 2008)
Berman Future of Light Prize Award (2009, 2013)
Materials Science Innovation Grant Award (2016)
Schlumberger Research Fellowship Award (2015, 2016)
Nanotechnology Pilot Grant Award (2018)
Dean's Catalyst Award (2009, 2012, 2016)
The President's Award (2007, 2012)
The Provost's Award (2008)
SPRInG Award (2002)

Best Paper/Best Poster Awards:

2020: Microsystems & Nanoengineering – Nature Highly Cited Paper Award
2020: Springer Nature 2019 Highlights – one of the most popular articles by Springer Nature
2013: International Workshop on Optical Terahertz Science and Technology Best Poster Award
2013: ASME Global Congress on Nanoengineering for Medicine & Biology Outstanding Paper Award
2011: International Conference on Surface Plasmon Photonics Best Poster Award
2011: Journal of Physics D: Applied Physics 2010 Highlights
2010: IEEE Sensors Best Poster Award
2009: Journal of Micromechanics & Microengineering 2008 Highlights
2009: Journal of Physics D: Applied Physics 2008 Highlights
2008: ASME Society-Wide Micro and Nanotechnology Poster Forum Best Paper Award

Best Dissertation Awards:

2023: BU College of Engineering PhD Societal Impact Award (Student/Advisor: Wu/Zhang)
2019: BU Mechanical Engineering Best Dissertation Award (Student/Advisor Duan/ Zhang)
2013: BU Mechanical Engineering Best Dissertation Award (Student/Advisor: Du/Zhang)
2012: BU Mechanical Engineering Best Dissertation Award (Student/Advisor: Fan/Zhang)
2011: BU Engineering Best Dissertation Award (Student/Advisor: Zheng/Zhang)
2011: Ebner Graduate Thesis with Greatest Commercial Potential (Student/Advisor: Kaanta/Zhang)
2010: BU Engineering Best Dissertation Award (Student/Advisor: Tao/Zhang)
2009: Ebner Graduate Thesis with Greatest Commercial Potential (Student/Advisor: Hansen/Zhang)

Conferences Presentations

Over 300 conference presentations delivered in collaboration with students, postdocs, and colleagues over the past two decades. This includes numerous invited talks at prestigious conferences such as the IEEE IEDM, IEEE MEMS, IEEE NEMS, IEEE Sensors, Transducers, APCOT, IRMMW-THz, OTST, PIERS, I3S, META, ERMR, TechConnect World, and annual meetings of societies such as MRS, ASME, ASA, ACS, AIAA, TMS, SPIE, and others.

First/Current Positions Held by Former PhD Graduates and Postdocs from Zhang Lab in the USA:

University Professors:

University of California, Berkeley; University of California, Los Angeles; Virginia Tech; Ohio State University; University of Texas at Austin; Miami University; Boston University School of Medicine.

Independent Investigators at National Laboratories:

Draper Laboratory; Lawrence Livermore National Laboratory; MIT Lincoln Laboratory; Fermi National Accelerator Laboratory

Scientists at Major Labs, Centers, and Hospitals:

MIT Media Lab; Boston Medical Center; Brigham & Women's Hospital; Massachusetts General Hospital

Scientists/Engineers in Industry:

Agilent; Amazon; Analog Devices; Apple; Aramco; ASML; BioNTech; Entegris; Fraunhofer; GE Global Research; GE Renewable Energy; Keysight; Marvell Technology; Medtronic; Merck; Meta; PerkinElmer; Tesla; Western Digital

Scientists/Engineers at Startups:

Accion Systems; Argo AI; Cambridge Electronics; Lilliputian; Primetaz; RayVio

Director, NSF Research Experiences for Undergraduates (REU Site), Boston University Photonics Center (2015-present):

Overseeing a program that annually hosts ten undergraduate students in mentored, hands-on research experiences within Boston University's vibrant research community. This REU Site emphasizes broadening STEM talent by prioritizing the recruitment of underrepresented minorities (URM), women, and students from diverse backgrounds. Each cohort includes at least 50% URM, 50% women, and 50% participants from 2- and 4-year colleges with limited research opportunities. Through focused recruitment, the program consistently reaches 70% female and 80% URM participation, including Black or African American, Hispanic or Latino, and American Indian or Alaska Native students.

Director, NSF Research Experiences for Teachers (RET Site), Boston University Photonics Center (2015-present):

Directing an annual program that immerses ten high school and community college teachers—particularly those from underrepresented minority (URM) backgrounds—in Boston University laboratory research experiences. This RET Site focuses on educators from high-needs, high-minority high schools and community colleges in Greater Boston. In Massachusetts, "high-needs" schools are characterized by a high percentage of low-income students, English Language Learners (ELLs), and students with disabilities.

Associate Director, Boston University Nanotechnology Innovation Center (BUnano, 2016-present):

Supporting the Boston University Nanotechnology Innovation Center (BUnano), an interdisciplinary research center advancing nanoscience, nanoengineering, and nanotechnology to address critical challenges in medicine, manufacturing, and energy. BUnano includes over 60 faculty members from 10 departments within the College of Engineering, College of Arts & Sciences, and School of Medicine, fostering interdisciplinary research and innovation.

News stories on metamaterials that significantly improve the performance of MRI:

"MRI is a complicated imaging modality and improving it requires a deep understanding of the physics involved," [*Healthcare-in-Europe*]. Dr. Zhang's metamaterials "boost MRI performance without increased magnetic field," [*Electronic Design & Microwaves & RF*]; "allow for more possibilities and the chance to simplify the technology," [*Science Times*]; "revolutionize MRI and medical imaging," [*Sathel Energia & MedImaging.net*]. "Shortening MRI examinations is paramount to maximizing the capacity. Not to mention revenue, as well as the overall patient experience of this powerful imaging technology," [*EurekAlert!*]. "The arrangement of this metamaterial is truly groundbreaking and innovative," [*NIH*];

"an additive technology," [*Pioneering Minds*]; "potentially making the modality more widely available for patients at lower costs," [*HealthImaging*]. "Crisper MRI now possible," [*Medgadget*]; "tiny structures that could end up making a massive impact," [Radiology Business]; "making the entire MRI process faster, safer, and more accessible to patients around the world," [*Phys.org*]. "Not bad for a few coils of wire," [*Physics World*]; "cost effective MRIs might soon become a reality," [*MDDI*]. "Quantum leap," [*Radiology Business*]; "a substantial improvement in image quality for the first time," [*NIH*]; "things will get seamless very soon," [*Times Tech Pharm*]. We can "even envision the metamaterial being used with ultra-low field MRI," [*EurekAlert!*]; "which uses magnetic fields that are thousands of times lower than the standard machines currently in use," [*Phys.org*]. "This would open the door for MRI technology to become widely available around the world," [*Science Daily*].

News stories on metamaterials that can create better brain scans:

"You can keep your hat on (in the MRI). If I told you an MRI revolution was coming, you probably wouldn't expect it to come dressed like this," [*Medical Republic*]. "It may look like a bizarre bike helmet, or a piece of equipment found in Doc Brown's lab in Back to the Future, yet this gadget made of plastic and copper wire is a technological breakthrough with the potential to revolutionize medical imaging," [*Imaging Technology News*]. "Despite its playful look, the device is actually a metamaterial, packing in a ton of physics, engineering and mathematical know-how," [*Science Daily*]. "Funky helmet enhances MRI brain scans. What if a simple device, made from plastic and copper wire, could help with all of these issues, and look like a goofy toy for kids in the process? Look no further." [*Medgadget*]. "Thanks to the playful design, the piece of headwear looks like it's straight from a mad scientist's laboratory, but there is a method to the madness. The uses of these magnificent metamaterials spread far and wide," [*The Optimist Daily*]. "Raising the floor beyond all expectations. There is hope among the researchers that the technology will eventually have enough in the tank to work with low-field MRI scanners. Assuming the said goal is realized, people living in underdeveloped areas will also end up getting a fair shot at reaping its benefits," [*Medhealth Outlook*].

News stories on metamaterials that enable air-permeable sound silencing and noise reduction:

"Though less publicized than its notorious air and water counterparts, noise pollution is a growing problem," [*Geek.com*]. Dr. Zhang and her team at Boston University "have recently made a remarkable discovery," [*Bold Business*]; "have created a new kind of material," [*Smithsonian*]; "have come up with a solution that outperforms them all," [*Gizmodo*]; and "have done the seemingly impossible," [*ASME*]. "Shape blocking sound," [*Alliant*]. "This is quite a feat of metamaterial design," [*Fabbaloo*]; which "could help bring peace and quiet to our lives," [*Digital Trends*]. "Whether at work, in health or in transport, this soundproofing ring could change our lives," [*Business Insider*]; "to curtail noise from aircraft, fans and HVAC systems without interfering with the airflow," [*Smithsonian*]. "So there are all kinds of mechanical applications that would benefit from lightweight, see-through soundproofing that can stop noise, but still allow air to flow freely. And that's what Zhang's team did," [*The Wall Street Journal*]. "Metamaterials block noise without hindering air flow," [*Design News*]; "with endless applications for the technology in different fields," [*SolidSmack*]. "Ring of silence," [*Thomas Insights*]. "A meta-material to end noise pollution," [*Plastics le mag*]; "that is as cool as it sounds!" [*Mashable*]. "The potential uses are endless," [*Built in Boston*]. "There's really no limit to the possibilities," [*Fast Company*]. "The strongest sound insulation research in history!" [*TechOrange*]. "The industry is crazy!" [*L'Usine nouvelle*]. "This could be a whole new industry," [*Fabbaloo*]; and "we may finally have a 3DPrinter popular hit," [*WIRED*]. "The structure is also very lightweight and looks beautiful," [*Mashable*]. "The discovery could have a significant impact on architecture and design," [*Hunker*]. "A new (and quiet) era of acoustics is opening up," [*Discoveries News*]. "The mindfulness industry, which is set to become a $2 billion business by 2022 may also benefit from these advances," [*Future Science News*]. "The future is coming, and it's just the right volume," [*Curiosity*].

Journal Publications

*#denotes graduate students/postdocs supervised by Prof. Xin Zhang; *denotes corresponding author by X. Zhang.*

[203]. Ballistic transport enhanced heat convection at nanoscale hotspots
S. Xu, Y. Xu, J. Zhang, J. Gao, X. Wang,, **X. Zhang**, Y. Xue#
Journal of Applied Physics, 2024, 136(16): 164306

[202]. Two-sided acoustic modulator for broadband and individual control of reflected and transmitted sound waves
A. Chen#, **X. Zhang***
Physical Review Applied, 2024, 22(4): 044010

[201]. Learning to reconstruct accelerated MRI through K-space cold diffusion without noise
G. Shen#, M. Li#, C.W. Farris, S.W. Anderson, **X. Zhang***
Scientific Reports – Nature, 2024, 14: 21877

[200]. A robust near-field body area network based on coaxially-shielded textile metamaterial
X. Zhu#, K. Wu#, X. Xie#, S.W. Anderson, **X. Zhang***
Nature Communications, 2024, 15: 6589

[199]. Diatom Cribellum-inspired hierarchical metamaterials: Unifying perfect absorption towards subwavelength color printing
X. Xie#, Y. Huang#, Z. Yang#, A. Li#, **X. Zhang***
Advanced Materials, 2024, 36(33): 2403304

[198]. Wireless, customizable coaxially shielded coils for magnetic resonance imaging
K. Wu#, X. Zhu#, S.W. Anderson, **X. Zhang***
Science Advances, 2024, 10(24): eadn5195

[197]. All-silicon active bound states in the continuum terahertz metamaterials
Y. Huang#, K. Kaj, Z. Yang#, E. Alvarado, W. Man, Y. Zhang, V. Ramaprasad, R.D. Averitt, **X. Zhang***
Optics and Laser Technology, 2024, 179: 111176

[196]. Wearable coaxially-shielded metamaterial for targeted magnetic resonance imaging
X. Zhu#, K. Wu#, S.W. Anderson, **X. Zhang***
Advanced Materials, 2024, 36(31): 2313692

[195]. Computational-design enabled wearable and tunable metamaterials via freeform auxetics for magnetic resonance imaging
K. Wu#, X. Zhu#, S.W. Anderson, **X. Zhang***
Advanced Science, 2024, 11(26): 2400261

[194]. Angle-variant metamaterial with reconfigurable phase modulation
A. Chen#, Z. Yang#, S. Anderson, **X. Zhang***
Physical Review Applied, 2024, 21(1): 014062

[193]. Attention hybrid variational net for accelerated MRI reconstruction
G. Shen#, B. Hao, M. Li#, C.W. Farris, I.C. Paschalidia, S.W. Anderson, **X. Zhang***
APL Machine Learning, 2023, 1(4): 046116

[192]. Distributionally robust image classifiers for stroke diagnosis in accelerated MRI
B. Hao, G. Shen#, R. Chen, C.W. Farris, S.W. Anderson, **X. Zhang**, I.C. Paschalidia
Proceeding of the 26th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2023), Vancouver, Canada, October 8-12, 2023, pp. 768-777.

[191]. Helmholtz coil-inspired volumetric wireless resonator for magnetic resonance imaging
X. Zhu#, K. Wu#, S.W. Anderson, **X. Zhang***
Advanced Materials Technologies, 2023, 8(22): 2301053

[190]. Bayesian reconstruction of magnetic resonance k-space images using Gaussian processes
Y. Xu, C. Farris, S. Anderson, **X. Zhang**, K.A. Brown
Scientific Reports – Nature, 2023, 13: 12527

[189]. Tunable bound states in the continuum in a reconfigurable terahertz metamaterial
Y. Huang#, K. Kaj, Z. Yang#, R.D. Averitt, **X. Zhang***
Advanced Optical Materials, 2023, 11(4): 2300559

[188]. Composite acoustic metamaterial for broadband low-frequency acoustic attenuation
A. Chen#, Z. Yang#, X. Zhao#, S. Anderson, **X. Zhang***
Physical Review Applied, 2023, 20(1): 014011

[187]. Steady-state monitoring of oxygen in a high-throughput organ-on-chip platform enables rapid and non-invasive assessment of drug-induced nephrotoxicity
S.H. Kann#, E.M. Shaughnessey, **Xin Zhang***, J.L. Charest, E.M. Vedula
Analyst, 2023, 148(14): 3204-3216

[186]. Broadband labyrinthine acoustic insulator
A. Chen#, X. Zhao#, Z. Yang#, S. Anderson, **X. Zhang***
Physical Review Applied, 2022, 18(6): 064057

[185]. Complementary vanadium dioxide metamaterial with enhanced modulation amplitude at terahertz frequencies
Y. Huang#, X. Wu#, J. Schalch, G. Duan#, C. Chen#, X. Zhao#, K. Kaj, H-T Zhang, R. Engel-Herbert, R.D. Averitt, **X. Zhang***
Physical Review Applied, 2022, 18(5): 054086

[184]. Measurement of oxygen consumption rates of human renal proximal tubule cells in an array of organ-on-chip devices to monitor drug-induced metabolic shifts
S.H. Kann#, E.M. Shaughnessey, J.R. Coppeta, H. Azizgolshani, B.C. Isenberg, E.M. Vedula, **X. Zhang***, J.L. Charest
Microsystems and Nanoengineering – Nature, 2022, 8: 109

[183]. Quantitative MRI characterization of the extremely preterm brain at adolescence: atypical versus neurotypical developmental pathways
R. McNaughton#, C. Pieper, O. Sakai, J. Rollins, **X. Zhang**, D. Kennedy, J.A. Frazier, L. Douglass, R.C. Fry, T.M. O'Shea, H. Jara, K. Kuban, for the ELGAN-ECHO study Investigators
Radiology, 2022, 304(2): 419-428

[182]. Regulatory effects of gradient microtopographies on synapse formation and neurite growth in hippocampal neurons

R. McNaughton#, Y. Huo, G. Li#, A. Di Via Ioschpe, L. Yan#, H-Y Man, **X. Zhang***
Journal of Micromechanics and Microengineering, 2022, 32(7): 075005

[181]. Broadband terahertz silicon membrane metasurface absorber
Y. Huang#, K. Kaj, C. Chen#, Y. Huang#, S.R. Haque, Y. Zhang, X. Zhao#, R.D. Averitt, **X. Zhang***
ACS Photonics, 2022, 9(4): 1078-1095

[180]. Metamaterial-enhanced near-field readout platform for passive microsensor tags
K. Wu#, D. Duan#, C. Chen#, S.W. Anderson, X. Zhao#, **X. Zhang***
Microsystems and Nanoengineering – Nature, 2022, 8: 28

[179]. Auxetics-inspired tunable metamaterials for magnetic resonance imaging
K. Wu#, X. Zhao#, T.G. Bifano, S.W. Anderson, **X. Zhang***
Advanced Materials, 2022, 34(6): 2109032

[178]. On-demand terahertz surface wave generation with microelectromechanical-system-based metasurface
C. Chen#, K. Kaj, X. Zhao#, Y. Huang#, R.D. Averitt, **X. Zhang***
Optica, 2022, 9(1): 17-25

[177]. 3D printing of true pore-scale Berea sandstone and digital rock verification
A. Li#, S. Zhang, C. Xu, X. Zhao#, **X. Zhang***
SPE Journal, 2021, 26(06): 3719-3724

[176]. Nanotextured dynamics of a light-induced phase transition in VO_2
A.J. Sternbach, F.L. Ruta, Y. Shi, T. Slusar, J. Schalch, G. Duan#, A. McLeod, **X. Zhang**, M. Liu, A.J. Millis, H-T Kim, L-Q Chen, R.D. Averitt, D.N. Basov
Nano Letters, 2021, 21(21): 9052-9060

[175]. Tunable toroidal response in a reconfigurable terahertz metamaterial
C. Chen#, K. Kaj, Y. Huang#, X. Zhao#, R.D. Averitt, **X. Zhang***
Advanced Optical Materials, 2021, 9(22): 2101215

[174]. Absorption mode splitting of terahertz metamaterial mediated by coupling of spoof surface plasmon polariton
Z. Cui, Y. Wang#, L. Yue, X. Zhao#, D. Zhang, X. Zhang, L. Hou, **X. Zhang***
IEEE Transactions on Terahertz Science and Technology, 2021, 11(6): 626-634

[173]. High thermal conductivity of free-standing skeleton in graphene foam
J. Gao, D. Xie, X. Wang, **X. Zhang**, Y. Yue#
Applied Physics Letters, 2021, 117(25): 251901

[172]. Unltrathin terahertz triple band metamaterial absorbers: consideration of interlayer coupling
C. Chen#, S. Can#, J. Schalch, X. Zhao#, G. Duan#, R.D. Averitt, **X. Zhang***
Physical Review Applied, 2020, 14(5): 054021

[171]. Terahertz investigation of bound states in the continuum of metallic metasurfaces
X. Zhao#, C. Chen#, K. Kaj, I. Hammock, Y. Huang#, R.D. Averitt, **X. Zhang***
Optica, 2020, 7(11): 1548-1554

[170]. Polarization insensitive, metamaterial absorber-enhanced long-wave infrared detector

C. Chen#, Y. Huang#, K. Wu#, T.G. Bifano, S.W. Anderson, X. Zhao#, **X. Zhang***
Optics Express, 2020, 28(20): 28843-28857

[169]. Nonreciprocal magnetic coupling using nonlinear meta-atoms
X. Zhao#, K. Wu#, C. Chen#, T.G. Bifano, S.W. Anderson, **X. Zhang***
Advanced Science, 2020, 7(19): 2001443

[168]. Broadband electrically tunable VO_2-metamaterial terahertz switch with suppressed reflection
J.S. Schalch, Y. Chi, Y. He, Y. Tang, X. Zhao#, **X. Zhang**, Q. Wen, R.D. Averitt
Microwave and Optical Technology Letters, 2020, 62(8): 2782-2790

[167]. Intelligent metamaterials based on nonlinearity for magnetic resonance imaging
X. Zhao#, G. Duan#, K. Wu#, S.W. Anderson, **X. Zhang***
Advanced Materials, 2019, 31(49): 1905461

[166]. Strong metasurface–Josephson plasma resonance coupling in superconducting $La_{2-x}Sr_xCuO_4$
J.S. Schalch, K. Post, G. Duan#, X. Zhao#, Y-D Kim, J. Hone, M.M. Fogler, **X. Zhang**, D.N. Basov, R.D. Averitt
Advanced Optical Materials, 2019, 7(21): 1900712

[165]. Terahertz-driven Stark spectroscopy of CdSe and CdSe-CdS core-shell quantum dots
B.C. Pein, C.K. Lee, L. Shi, J. Shi, W. Chang, H.Y. Hwang#, J. Scherer, I. Coropceanu, X. Zhao#, **X. Zhang**, V. Bulovic, M.G. Bawendi, A.P. Willard, K.A. Nelson
Nano Letters, 2019, 19(11): 8125-8131

[164]. Graphene nanofluids as thermal management materials: molecular dynamics study on orientation and temperature effects
J. Gao, H. Wu, A. Li#, Y. Yue#, D. Xie, **X. Zhang***
ACS Applied Nano Materials, 2019, 2(11): 6828-6835

[163]. Real-time tunable phase response and group delay in broadside coupled split-ring resonators
X. Zhao#, J. Zhang, K. Fan#, G. Duan#, J. Schalch, G.R. Keiser, R.D. Averitt*, **X. Zhang***
Physical Review B, 2019, 99(24): 245111

[162]. Diatom frustule-inspired metamaterial absorbers: the effect of hierarchical pattern arrays
A. Li#, X. Zhao#, G. Duan#, S.W. Anderson, **X. Zhang***
Advanced Functional Materials, 2019, 29(22): 1809029

[161]. Photo-induced terahertz near-field dynamics of graphene/InAs heterostructure
Z. Yao, J. Zhang, S. Mills, X. Zhao#, X. Chen, R. Mescall, V. Semenenko, H. Hu, T. Ciavatti, S. March, S.R. Bank, H. Tao, V. Perebeinos, **X. Zhang**, Q. Dai, X. Du, M. Liu
Optics Express, 2019, 27(10): 13611-13523

[160]. Plasmonic heating induced by Au nanoparticles for quasi-ballistic thermal transport in multi-walled carbon nanotubes
Y. Xu+, X. Zhao#,+, A. Li#, Y. Yue#, J. Jiang, **X. Zhang***
Nanoscale, 2019, 11(16): 7572-7581

[159]. Boosting magnetic resonance imaging signal-to-noise ratio using magnetic metamaterials
G. Duan#, X. Zhao#, S.W. Anderson, **X. Zhang***

Communications Physics – Nature, 2019, 2: 35

[158]. A survey of theoretical models for terahertz electromagnetic metamaterial absorbers
G. Duan#, J. Schalch, X. Zhao#, A. Li#, C. Chen#, R.D. Averitt, **X. Zhang***
Sensors and Actuators A: Physical, 2019, 287: 21-28

[157]. Integrating microsystems with metamaterials towards metadevices
X. Zhao#, G. Duan#, A. Li#, C. Chen#, **X. Zhang***
Microsystems and Nanoengineering – Nature, 2019, 5: 5

[156]. Optically modulated ultra-broadband all-silicon metamaterial terahertz absorbers
X. Zhao#, Y. Wang#, J. Schalch, G. Duan#, K. Cremin, J. Zhang, C. Chen#, R.D. Averitt*, **X. Zhang***
ACS Photonics, 2019, 6(4): 830-837

[155]. Implementing infrared metamaterial perfect absorbers using dispersive dielectric spacers
X. Zhao#, C. Chen#, A. Li#, G. Duan#, **X. Zhang***
Optics Express, 2019, 27(2): 1727-1739

[154]. Ultra-open acoustic metamaterial silencer based on Fano-like interference
R. Ghaffarivardavagh#, J. Nikolajczyk#, S. Anderson, **X. Zhang***
Physical Review B, 2019, 99(2): 024302

[153]. Glass fracture by focusing of laser-generated nanosecond surface acoustic waves
D. Veysset, S.E. Kooi, R. Haferssas, M. Hassani-Gangaraj, M. Islam, A.A. Maznev, Y. Chernukha, X. Zhao#, K. Nakagawa, D. Martynowich, **X. Zhang**, A.M. Lomonosov, C.A. Schuh, R. Radovitzky, T. Pezeril, K.A. Nelson
Scripta Materialia, 2019, 158: 42-45

[152]. Silica nanowire growth on *Coscinodiscus species* diatom frustules via vapor-liquid-solid process
A. Li#, X. Zhao#, S. Anderson, **X. Zhang***
Small, 2018, 14(47): 1801822

[151]. Relationship between central venous catheter protein adsorption and water infused surface protection mechanisms
D.W. Sutherland#, Z.D. Blanks, **X. Zhang**, J.L. Charest
Artificial Organs, 2018, 42(11): E369-E379

[150]. An air-spaced terahertz metamaterial perfect absorber
G. Duan#, J. Schalch, X. Zhao#, J. Zhang, R.D. Averitt*, **X. Zhang***
Sensors and Actuators A: Physical, 2018, 208: 303-308

[149]. Terahertz metamaterial perfect absorber with continuously tunable air spacer layer
J. Schalch, G. Duan#, X. Zhao#, **X. Zhang***, R.D. Averitt*
Applied Physics Letters, 2018, 113(6): 061113

[148]. Time-domain transient fluorescence spectroscopy for thermal characterization of polymers
H. Wu, K. Cai, H. Zeng, W. Zhao, D. Xie, Y. Yue#, Y. Xiong, **X. Zhang***
Applied Thermal Engineering, 2018, 138: 403-408

[147]. Horn-like space-coiling metamaterials toward simultaneous phase and amplitude modulation

R. Ghaffarivardavagh#, J. Nikolajczyk#, R.G. Holt, S.W. Anderson, **X. Zhang***
Nature Communications, 2018, 9: 1349

[146]. Electromechanically tunable metasurface transmission waveplate at terahertz frequencies
X. Zhao#, J. Schalch, J. Zhang, H.R. Seren#, R.D. Averitt*, **X. Zhang***
Optica, 2018, 5(3): 303-310

[145]. Analysis of the thickness dependence of metamaterial absorbers at terahertz frequencies
G. Duan#, J. Schalch, X. Zhao#, J. Zhang, R.D. Averitt*, **X. Zhang***
Optics Express, 2018, 26(3): 2242-2251

[144]. Terahertz dispersion characteristics of super-aligned multi-walled carbon nanotubes and enhanced transmission through subwavelength apertures
Y. Wang#, G. Duan#, L. Zhang, L. Ma, X. Zhao#, **X. Zhang***
Scientific Reports – Nature, 2018, 8: 2087

[143]. Identifying the perfect absorption of metamaterial absorbers
G. Duan#, J. Schalch, X. Zhao#, J. Zhang, R.D. Averitt*, **X. Zhang***
Physical Review B, 2018, 97(3): 035128

[142]. Water infused surface protection as an active mechanism for fibrin sheath prevention in central venous catheters
D.W. Sutherland#, **X. Zhang**, J.L. Charest
Artificial Organs, 2017, 41(10): E155-E165

[141]. A magnetically coupled communication and charging platform for microsensors
G. Duan#, X. Zhao#, H.R. Seren#, **X. Zhang***
Journal of Microelectromechanical Systems, 2017, 26(5): 1099-1109

[140]. Terahertz-driven luminescence and colossal Stark effect in CdSe:CdS colloidal quantum dots
B.C. Pein, W. Chang, H.Y. Hwang#, J. Scherer, I. Coropceanu, X. Zhao#, **X. Zhang**, V. Bulovic, M. Bawendi, K.A. Nelson
Nano Letters, 2017, 17(9): 5375-5380

[139]. A three-dimensional all-metal terahertz metamaterial perfect absorber
M. Wu#, X. Zhao#, J. Zhang, K. Cremin, J. Schalch, G. Duan#, R.D. Averitt*, **X. Zhang***
Applied Physics Letters, 2017, 111(5): 051101

[138]. Towards uniformly oriented diatom frustule monolayers: experimental and theoretical analyses
A. Li#, W. Zhang#, R. Ghaffarivardavagh#, X. Wang#, S.W. Anderson, **X. Zhang***
Microsystems and Nanoengineering - Nature, 2016, 2: 16064

[137]. Terahertz saturable absorption in superconducting metamaterials
G.R. Keiser#, J. Zhang, X. Zhao#, **X. Zhang***, R.D. Averitt*
Journal of the Optical Society of America B, 2016, 33(12): 2649-2655

[136]. Microfluidic channel-based wireless charging and communication platform for microsensors with miniaturized onboard antenna
G. Duan#, X. Zhao#, H.R. Seren#, C. Chen#, A. Li#, **X. Zhang***

Journal of Micromechanics and Microengineering, 2016, 26(12): 124002

[135]. Broadband extraordinary terahertz transmission through super-aligned carbon nanotubes film
Y. Wang#, X. Zhao#, G. Duan#, **X. Zhang***
Optics Express, 2016, 24(14): 15730-15741

[134]. Voltage-tunable dual-layer terahertz metamaterials
X. Zhao#, K. Fan#, J. Zhang, G.R. Keiser, G. Duan#, R.D. Averitt*, **X. Zhang***
Microsystems and Nanoengineering - Nature, 2016, 2: 16025

[133]. Nonlinear terahertz metamaterial perfect absorbers using GaAs
X. Zhao#, J. Zhang, K. Fan#, G. Duan#, G.D. Metcalfe, M. Wraback, **X. Zhang***, R.D. Averitt*
Photonics Research, 2016, 4(3): A16-A21

[132]. Nonlinear terahertz devices utilizing semiconducting plasmonic metamaterials
H.R. Seren#, J. Zhang, G.R. Keiser, S.J. Maddox, X. Zhao#, K. Fan#, S.R. Bank, **X. Zhang***, R.D. Averitt*
Light: Science & Applications – Nature, 2016, 5: 16078

[131]. Transmission properties of terahertz waves through asymmetric rectangular aperture arrays on carbon nanotube films
Y. Wang#, Y. Tong, **X. Zhang***
AIP Advances, 2016, 6(4): 045304

[130]. Tunable meta-liquid crystals
M. Liu, K. Fan#, W. Padilla, D.A. Powell, **X. Zhang**, I.V. Shadrivov
Advanced Materials, 2016, 28(8): 1553-1558

[129]. Terahertz radiation-induced sub-cycle field electron emission across a split-gap dipole antenna
J. Zhang+, X. Zhao#,+, K. Fan#, X. Wang#, G-F Zhang, K. Geng, **X. Zhang***, R.D. Averitt*
Applied Physics Letters, 2015, 107(23): 231101

[128]. Centimeter level monolayer close-packed of disk-shaped diatomite particles
W. Zhang#, **X. Zhang**
Journal of Inorganic Materials, 2015, 30(11): 1208-1212

[127]. Biologically enabled micro- and nanostencil lithography using diatoms
J. Cai#, X. Wang#, A. Li#, S.W. Anderson, **X. Zhang***
Extreme Mechanics Letters, 2015, 4: 186-192

[126]. A review of non-linear terahertz spectroscopy with ultrashort tabletop-laser pulses
H.Y. Hwang#, S. Fleischer, N.C. Brandt, B.G. Perkins, M. Liu, K. Fan#, A.J. Sternbach, **X. Zhang**, R.D. Averitt, K.A. Nelson
Journal of Modern Optics, 2015, 62(8): 1447-1479

[125]. Optically tunable metamaterial perfect absorber on highly flexible substrate
X. Zhao#, K. Fan#, J. Zhang, H.R. Seren#, G.D. Metcalfe, M. Wraback, R.D. Averitt*, **X. Zhang***
Sensors and Actuators A: Physical, 2015, 231: 74-80

[124]. Visualization of guided and leaky wave behaviors in an indium tin oxide metallic slab waveguide
S.M. Teo, C.A. Werley, C. Wang#, K. Fan#, B.K. Ofori-Okai, **X. Zhang**, R.D. Averitt, K.A. Nelson,
Optics Express, 2015, 23(11): 14876-14896

[123]. A role for matrix stiffness in the regulation of cardiac side population cell function
Y. Qiu#, A.F. Bayomy, M.V. Gomez, M. Bauer, P. Du#, Y. Yang, **X. Zhang**, R. Liao
AJP-Heart and Circulatory Physiology, 2015, 308(9): H990-H997

[122]. Enabling a microfluidic RFID readout system via miniaturization and integration
H.R. Seren#, X. Zhao#, C. Chen#, C. Wang#, **X. Zhang***
Journal of Microelectromechanical Systems, 2015, 24(2): 395-403

[121]. Optically modulated multi-band terahertz perfect absorber
H.R. Seren#, G.R. Keiser, L. Cao, J. Zhang, A.C. Strikwerda, K. Fan#, G.D. Metcalfe, M. Wraback, **X. Zhang***, R.D. Averitt*
Advanced Optical Materials, 2014, 2(12): 1221-1226

[120]. Structural control of metamaterial oscillator strength and electric field enhancement at terahertz frequencies
G.R. Keiser, H.R. Seren#, L. Cao, J. Zhang, A.C. Strikwerda, K. Fan#, G.D. Metcalfe, M. Wraback, **X. Zhang***, R.D. Averitt*
Applied Physics Letters, 2014, 105(8): 081112

[119]. Cell force mapping using a double-sided micropillar array based on the moiré fringe method
F. Zhang#, S. Anderson, X. Zheng#, E. Roberts#, Y. Qiu#, R. Liao, **X. Zhang***
Applied Physics Letters, 2014, 105(3): 033702

[118]. Numerical investigation of components influence on characteristics of autothermal reforming of methane in micro premix chamber
Y. Yan#, W. Tang, L. Zhang, **X. Zhang**, L. Niu, K. Liu, J. Zhu
International Journal of Hydrogen Energy, 2014, 39(22): 11583-11591

[117]. Biocompatible, micro- and nano-fabricated magnetic cylinders for potential use as contrast agents for magnetic resonance imaging
C. Wang#, X. Wang#, S.W. Anderson, **X. Zhang***
Sensors and Actuators B: Chemical, 2014, 196: 670-675

[116]. Fabrication and characterization of composite hydrogel particles with x-ray attenuating payloads
C. Wang#, X. Wang#, S. Anderson, **X. Zhang***
Journal of Vacuum Science & Technology B, 2014, 32(3): 032001

[115]. Optically tunable terahertz metamaterials on highly flexible substrates
K. Fan#, X. Zhao#, J. Zhang, G.R. Keiser, H.R. Seren#, G.D. Metcalfe, M. Wraback, **X. Zhang***, R.D. Averitt*
IEEE Transactions on Terahertz Science and Technology, 2013, 3(6): 702-708

[114]. Microfabricated iron oxide particles for tunable, multispectral magnetic resonance imaging
X. Wang#, C. Wang#, S. Anderson, **X. Zhang***, *Materials Letters*, 2013, 110: 122-126.

[113]. Towards dynamic, tunable, and nonlinear metamaterials via near field interactions: A review
G.R. Keiser, K. Fan#, **X. Zhang***, R.D. Averitt*
Journal of Infrared, Millimeter, and Terahertz Waves, 2013, 34(11): 709-723

[112]. Characterization of the Young's modulus and residual stresses for a sputtered silicon oxynitride film using micro-structures
J. Dong#, P. Du#, **X. Zhang***
Thin Solid Films, 2013, 545, 414-418

[111]. Decoupling crossover in asymmetric broadside coupled split-ring resonators at terahertz frequencies
G.R. Keiser, A.C. Strikwerda, K. Fan#, V. Young, **X. Zhang***, R.D. Averitt*
Physical Review B, 2013, 88(2): 024101

[110]. Topographically-patterned porous membranes in a microfluidic device as an *in vitro* model of renal reabsorptive barriers
E.M. Frohlich#, J.L. Alonso, J.T. Borenstein, **X. Zhang**, M.A. Arnaout, J.L. Charest
Lab on a Chip, 2013, 13(12): 2311-2319

[109]. Nonlinear terahertz metamaterials via field-enhanced carrier dynamics in GaAs
K. Fan#, H.Y. Hwang#, M. Liu, A.C. Strikwerda, A.J. Sternbach, J. Zhang, X. Zhao#, **X. Zhang**, K.A. Nelson, R.D. Averitt
Physical Review Letters, 2013, 110(21): 217404

[108]. Tunable electrical and mechanical responses of PDMS and polypyrrole nanowire composites
P. Du#, X. Lin, **X. Zhang***
Journal of Physics D: Applied Physics, 2013, 46(19): 195303

[107]. Three-dimensional broadband tunable terahertz metamaterials
K. Fan#, A.C. Strikwerda, **X. Zhang***, R.D. Averitt*
Physical Review B – Rapid Communications, 2013, 87(16): 161104

[106]. Investigation of cellular contraction forces in the frequency domain using a PDMS micropillar-based force transducer
P. Du#, C. Chen, H. Lu, **X. Zhang***
Journal of Microelectromechanical Systems, 2013, 22(1): 44-53

[105]. Terahertz-field-induced insulator-to-metal transition in vanadium dioxide metamaterial
M. Liu+, H.Y. Hwang#,+, H. Tao#, A.C. Strikwerda, K. Fan#, G.R. Keiser, A.J. Sternbach, K.G. West, S. Kittiwatanakul, J. Lu, S.A. Wolf, F.G. Omenetto, **X. Zhang**, K.A. Nelson, R.D. Averitt
Nature, 2012, 487(7407): 345-348

[104]. THz near-field Faraday imaging in hybrid metamaterials
N. Kumar, A.C. Strikwerda, K. Fan#, **X. Zhang**, R.D. Averitt, P.C.M. Planken, A.J.L. Adam
Optics Express, 2012, 20(10): 11277-11287

[103]. Time-resolved imaging of near-fields in THz antennas and direct quantitative measurement of field enhancements
C.A. Werley, K. Fan#, A.C. Strikwerda, S.M. Teo, **X. Zhang**, R.D. Averitt, K.A. Nelson
Optics Express, 2012, 20(8): 8551-8567

[102]. Three-dimensional magnetic terahertz metamaterials using a multilayer electroplating technique
K. Fan#, A.C. Strikwerda, R.D. Averitt*, **X. Zhang***
Journal of Micromechanics and Microengineering, 2012, 22(4): 045011

[101]. Effects of composition and thermal annealing on the mechanical properties of silicon oxycarbide films
P. Du#, X. Wang#, I-K Lin#, **X. Zhang***
Sensors and Actuators A: Physical, 2012, 176: 90-98

[100]. Thermal conductivity and photoluminescence of light-emitting silicon nitride films
A. Marconnet, M. Panzer, S. Yerci, S. Minissale, X. Wang#, **X. Zhang**, L.D. Negro, K.E. Goodson
Applied Physics Letters, 2012, 100(5): 051908

[99]. Single-layer terahertz metamaterials with bulk optical constants
W.-C. Chen, A. Totachawattana, K. Fan#, J.L. Ponsetto, A.C. Strikwerda, **X. Zhang**, R.D. Averitt, W.J. Padilla
Physical Review B, 2012, 85(3): 035112

[98]. Flexible metamaterial absorbers for stealth applications at terahertz frequencies
K. Iwaszczuk, A.C. Strikwerda, K. Fan#, **X. Zhang**, R.D. Averitt, P. Uhd Jepsen
Optics Express, 2012, 20(1): 635-643

[97]. The use of controlled surface topography and flow-induced shear stress to influence renal epithelial cell function
E.M. Frohlich#, **X. Zhang**, J.L. Charest
Integrative Biology, 2012, 4(1): 75-83

[96]. A PDMS microfluidic impedance immunosensor for *E. coli O157:H7* and *Staphylococcus aureus* detection via antibody-immobilized nanoporous membrane
F. Tan, P.H.M. Leung, Z-B Liu, Y. Zhang, L. Xiao, W. Ye, **X. Zhang**, L. Yi, M. Yang
Sensors and Actuators B: Chemical, 2011, 159(1): 328-335

[95]. Extremely thin metamaterial as slab waveguide at terahertz frequencies
Y. Minowa, M. Nagai, H. Tao#, K. Fan#, A.C. Strikwerda, **X. Zhang**, R.D. Averitt, K. Tanaka
IEEE Transactions on Terahertz Science and Technology, 2011, 1(2): 441-449

[94]. Microwave and terahertz wave sensing with metamaterials
H. Tao#, E.A. Kadlec, A.C. Strikwerda, K. Fan#, W.J. Padilla, R.D. Averitt, E.A. Shaner, **X. Zhang***
Optics Express, 2011, 19(22): 21620-21626

[93]. Electromagnetic composite-based reflecting terahertz waveplates
A.C. Strikwerda, R.D. Averitt, K. Fan#, **X. Zhang**, G.D. Metcalfe, M. Wraback
International Journal of High Speed Electronics and Systems, 2011, 20(3): 583-588

[92]. Effect of loading rates on cellular force measurements by polymer micropillar based transducers
P. Du#, X. Zheng#, I-K Lin#, **X. Zhang***
Applied Physics Letters, 2011, 99(8): 083701

[91]. Metamaterials on paper as a sensing platform
H. Tao#, L. Chieffo, M.A. Brenckle, S.M. Siebert, M. Liu, A.C. Strikwerda, K. Fan#, D.L. Kaplan, **X. Zhang***, R.D. Averitt*, F.G. Omenetto*
Advanced Materials, 2011, 23(28): 3197-3201

[90]. Inelastic deformation of bilayer microcantilevers with nanoscale coating
I-K Lin#, **X. Zhang***, Y. Zhang*
Sensors and Actuators A: Physical, 2011, 168(1): 1-9

[89]. Mechanical property characterization of sputtered and plasma enhanced chemical deposition (PECVD) silicon nitride films after rapid thermal annealing
P-H Wu, I-K Lin#, H-Y Yan, K-S Ou, K-S Chen, **X. Zhang***
Sensors and Actuators A: Physical, 2011, 168(1): 117-126

[88]. Stand-up magnetic metamaterials at terahertz frequencies
K. Fan#, A.C. Strikwerda, H. Tao#, **X. Zhang***, R.D. Averitt*
Optics Express, 2011, 19(13): 12619-12627

[87]. Temperature distribution on thermal conductivity detectors for flow rate insensitivity
B.C. Kaanta#, A.J. Jonca#, H. Chen, **X. Zhang***
Sensors and Actuators A: Physical, 2011, 167(2): 146-151

[86]. Frequency tunable terahertz metamaterials using broadside coupled split-ring resonators
E. Ekmekci, A.C. Strikwerda, K. Fan#, G.R. Keiser, **X. Zhang**, G. Turhan-Sayan, R.D. Averitt
Physical Review B, 2011, 83(19): 193103

[85]. Opto-mechanical platforms for cell force study
X. Zheng# and **X. Zhang***, *Micro and Nano Letters*, 2011, 6(5): 332-336.

[84]. MEMS based structurally tunable metamaterials at terahertz frequencies
H. Tao#, A.C. Strikwerda, K. Fan#, W.J. Padilla, **X. Zhang***, R.D. Averitt*
Journal of Infrared, Millimeter, and Terahertz Waves, 2011, 32: 580-595

[83]. Microsystems for cellular force measurement: a review
X. Zheng# and **X. Zhang***, *Journal of Micromechanics and Microengineering*, 2011, 21(5): 054003.

[82]. Whole field decoupling of predistortion on polymeric cell force transducer
X. Zheng# and **X. Zhang***
Applied Physics Letters, 2011, 98(17): 173701

[81]. Effect of forced convection on thermal distribution in micro thermal conductivity detectors
B.C. Kaanta#, H. Chen, **X. Zhang***
Journal of Micromechanics and Microengineering, 2011, 21(4): 045017

[80]. Recent progress in electromagnetic metamaterial devices for terahertz applications
H. Tao#, W.J. Padilla, **X. Zhang***, R.D. Averitt*
IEEE Journal of Selected Topics in Quantum Electronics, 2011, 17(1): 92-101

[79]. Performance enhancement of terahertz metamaterials on ultrathin substrates for sensing applications

H. Tao#, A.C. Strikwerda, M. Liu, J.P. Mondia, E. Ekmekci, K. Fan#, D.L. Kaplan, W.J. Padilla, **X. Zhang**, R.D. Averitt, F.G. Omenetto

Applied Physics Letters, 2010, 97(26): 261909

[78]. A dual band terahertz metamaterial absorber

H. Tao#, C.M. Bingham, D. Pilon, K. Fan#, A.C. Strikwerda, D. Shrekenhamer, W.J. Padilla, **X. Zhang***, R.D. Averitt*

Journal of Physics D: Applied Physics, 2010, 43(22): 225102

[77]. A multilayer bending model for conducting polymer actuators

P. Du#, X. Lin, **X. Zhang***

Sensors and Actuators A: Physical, 2010, 163(1): 240-246

[76]. Novel device for calibration-free flow rate measurements in micro gas chromatographic systems

B.C. Kaanta#, H. Chen, **X. Zhang***

Journal of Micromechanics and Microengineering, 2010, 20(9): 095034

[75]. Extension of the beam theory for polymer bio-transducers with low aspect ratios and viscoelastic characteristics

P. Du#, I-K Lin#, H. Lu, **X. Zhang***

Journal of Micromechanics and Microengineering, 2010, 20(9): 095016

[74]. Metamaterial silk composites at terahertz frequencies

H. Tao#, J.J. Amsden, A.C. Strikwerda, K. Fan#, D.L. Kaplan, **X. Zhang***, R.D. Averitt*, F.G. Omenetto*

Advanced Materials, 2010, 22(32): 3527-3531

[73]. A versatile cell contractility mapping transducer utilizing moiré-based technique

X. Zheng#, H.K. Surks, **X. Zhang***

Journal of Microelectromechanical Systems, 2010, 19(4): 764-773

[72]. Single cell contractility studies based on compact moiré system over periodic gratings

X. Zheng#, H.K. Surks, **X. Zhang***

Applied Physics Letters, 2010, 96(21): 213705

[71]. A monolithically fabricated gas chromatography separation column with an integrated high sensitivity thermal conductivity detector

B.C. Kaanta#, H. Chen, **X. Zhang***

Journal of Micromechanics and Microengineering, 2010, 20(5): 055016

[70]. Transport, analyte detection and opto-electronic response of p-type CuO nanowires

B.J. Hansen#, N. Kouklin, G. Lu, I-K Lin#, J. Chen, **X. Zhang***

Journal of Physical Chemistry C, 2010, 114(6): 2440-2447

[69]. Reconfigurable terahertz metamaterials

H. Tao#, A.C. Strikwerda, K. Fan#, W.J. Padilla, **X. Zhang***, R.D. Averitt*

Physical Review Letters, 2009, 103(14): 147401

[68]. Viscoelastic characterization and modeling of polymer transducers for biological applications

I-K Lin#, K-S Ou, Y-M Liao, Y. Liu#, K-S Chen, **X. Zhang***

Journal of Microelectromechanical Systems, 2009, 18(5): 1087-1099

[67]. Intervention of cardiomyocyte death based on real-time monitoring of cell adhesion through impedance sensing
Y. Qiu#, R. Liao, **X. Zhang***
Biosensors and Bioelectronics, 2009, 25(1): 147-153

[66]. Thermomechanical behavior and microstructural evolution of SiN_x/Al bimaterial microcantilevers
I-K Lin#, **X. Zhang***, Y. Zhang*
Journal of Micromechanics and Microengineering, 2009, 19(8): 085010

[65]. Impedance-based monitoring of ongoing cardiomyocyte death induced by tumor necrosis factor-a
Y. Qiu#, R. Liao, **X. Zhang***
Biophysical Journal, 2009, 96(5): 1985-1991

[64]. ROCK isoform regulation of myosin ohosphatase and contractility in vascular smooth muscle cells
Y. Wang, X. Zheng#, N. Riddick, M. Bryden, W. Baur, **X. Zhang**, H.K. Surks
Circulation Research, 2009, 104(4): 531-540

[63]. Comparison of birefringent electric split-ring resonator and meanderline structures as quarter-wave plates at terahertz frequencies
A.C. Strikwerda+, K. Fan#,+, H. Tao#, D.V. Pilon, **X. Zhang***, R.D. Averitt*
Optics Express, 2009, 17(1): 136-149

[62]. Viscoelastic mechanical behavior of soft microcantilever-based force sensors
I-K Lin#, Y-M Liao, Y. Liu#, K-S Ou, K-S Chen, **X. Zhang***
Applied Physics Letters, 2008, 93(25): 251907

[61]. Highly flexible wide angle of incidence terahertz metamaterial absorber: design, fabrication, and characterization
H. Tao#, C.M. Bingham, A.C. Strikwerda, D. Pilon, D. Shrekenhamer, N.I. Landy, K. Fan#, **X. Zhang***, W.J. Padilla, R.D. Averitt*
Physical Review B – Rapid Communications, 2008, 78(24): 241103

[60]. Terahertz metamaterials on free-standing highly-flexible polyimide substrates
H. Tao#, A.C. Strikwerda, K. Fan#, C.M. Bingham, W.J. Padilla, **X. Zhang***, R.D. Averitt*, *Journal of Physics D: Applied Physics*, 2008, 41(23): 232004.

[59]. Planar wallpaper group metamaterials for novel terahertz applications
C.M. Bingham, H. Tao#, X. Liu, R.D. Averitt, **X. Zhang**, W.J. Padilla
Optics Express, 2008, 16(23): 18565-18575

[58]. An optical Moiré technique for cell traction force mapping
X. Zheng# and **X. Zhang***
Journal of Micromechanics and Microengineering, 2008, 18(12): 125006

[57]. Optical moiré as a visualization tool for living vascular cell contraction force mapping
X. Zheng# and **X. Zhang***

Applied Physics Letters, 2008, 93(16): 164106

[56]. Mechanical properties of sputtered silicon oxynitride films by nanoindentation
Y. Liu#, I-K Lin#, **X. Zhang***
Materials Science and Engineering A, 2008, 489(1-2): 294-301

[55]. Development of double-cantilever infrared detectors: fabrication, curvature control and demonstration of thermal detection
S. Huang#, H. Tao#, I-K Lin#, **X. Zhang***
Sensors and Actuators A: Physical, 2008, 145-146: 231-240

[54]. The deformation of microcantilever-based infrared detectors during thermal cycling
I-K Lin#, Y. Zhang, **X. Zhang***
Journal of Micromechanics & Microengineering, 2008, 18: 075012

[53]. A metamaterial absorber for the terahertz regime: Design, fabrication and characterization
H. Tao#, N.I. Landy, C.M. Bingham, **X. Zhang**, R.D. Averitt, W.J. Padilla
Optics Express, 2008, 16(10): 7181-7188

[52]. Nanoindentation stress–strain curves of plasma-enhanced chemical vapor deposited silicon oxide thin films
Z. Cao# and **X. Zhang***
Thin Solid Films, 2008, 516(8): 1941-1951

[51]. Real-time monitoring primary cardiomyocyte adhesion based on electrochemical impedance spectroscopy and electrical cell-substrate impedance sensing
Y. Qiu#, R. Liao, **X. Zhang***
Analytical Chemistry, 2008, 80(4): 990-996

[50]. Profile control in silicon nanostructures using fluorine-enhanced oxide passivation
Y. Zhao# and **X. Zhang***
IEEE Transactions on Nanotechnology, 2008, 7(1): 40-47

[49]. Simultaneous orientation and cellular force measurements in adult cardiac myocytes using three-dimensional polymeric microstructures
Y. Zhao#, C.C. Lim, D.B. Sawyer, R. Liao, **X. Zhang***
Cell Motility and the Cytoskeleton, 2007, 64(9): 718-725

[48]. Study of gradient stress in bimaterial cantilever structures for infrared applications
S. Huang# and **X. Zhang***
Journal of Micromechanics and Microengineering, 2007, 17(7): 1211-1219

[47]. Adaptation of myofibrils to a microstructured polymeric substrate
Y. Zhao# and **X. Zhang***
Sensors and Actuators A: Physical, 2007, 136(2): 491-495

[46]. A novel impedance assay for cardiac myocyte hypertrophy sensing
M. Yang# and **X. Zhang***
Sensors and Actuators A: Physical, 2007, 136(2): 504-509

[45]. Electrical assisted patterning of cardiac myocytes with controlled macroscopic anisotropy using a microfluidic dielectrophoresis chip
M. Yang# and **X. Zhang***
Sensors and Actuators A: Physical, 2007, 135(1): 73-79

[44]. A novel microfluidic impedance assay for monitoring endothelin-induced cardiomyocyte hypertrophy
M. Yang#, C.C. Lim, R. Liao, **X. Zhang***
Biosensors and Bioelectronics, 2007, 22(8): 1688-1693

[43]. Gradient residual stress induced elastic deformation of multilayer MEMS structures
S. Huang# and **X. Zhang***
Sensors and Actuators A: Physical, 2007, 134(1): 177-185

[42]. Nanoindentation creep of plasma-enhanced chemical vapor deposited silicon oxide thin films
Z. Cao# and **X. Zhang***
Scripta Materialia, 2007, 56(3): 249-252

[41]. Oriented and vectorial patterning of cardiac myocytes using a microfluidic dielectrophoresis chip – towards engineered cardiac tissue with controlled macroscopic anisotropy
M. Yang#, C.C. Lim, R. Liao, **X. Zhang***
Journal of Microelectromechanical Systems, 2006, 15(6): 1483-1491

[40]. Size-dependent creep behaviour of plasma-enhanced chemical vapour deposited silicon oxide films
Z. Cao# and **X. Zhang***
Journal of Physics D: Applied Physics, 2006, 39(23): 5054-5063

[39]. Determination of the deformations in polymeric nanostructures using geometric moiré techniques for biological applications
Y. Zhao# and **X. Zhang***
Sensors and Actuators B: Chemical, 2006, 117(2): 376-383

[38]. Elimination of stress-induced curvature in microcantilever infrared focal plane arrays
S. Huang#, B. Li#, **X. Zhang***
Sensors and Actuators A: Physical, 2006, 130-131: 331-339

[37]. Microchip for subcellular mechanics study in living cells
Y. Zhao#, C.C. Lim, D.B. Sawyer, R. Liao, **X. Zhang***
Sensors and Actuators B: Chemical, 2006, 114(2): 1108-1115

[36]. Fabrication of three-dimensional microstructures based on singled-layered SU-8 for lab-on-chip applications
H. Yu#, O. Balogun, B. Li#, T.W. Murray, **X. Zhang***
Sensors and Actuators A: Physical, 2006, 127(2): 228-34

[35]. Experiments and theory of thermally-induced stress relaxation in amorphous dielectric films for MEMS and IC application
Z. Cao# and **X. Zhang***
Sensors and Actuators A: Physical, 2006, 127(2): 221-227

[34]. An approach for creating polymeric microstructures with various aspect ratios for cellular analysis applications
Y. Zhao# and **X. Zhang***
Sensors and Actuators A: Physical, 2006, 127(2): 216-220

[33]. Extension of the Stoney formula for film–substrate systems with gradient stress for MEMS applications
S. Huang# and **X. Zhang***
Journal of Micromechanics and Microengineering, 2006, 16(2): 382-389

[32]. Flexible fabrication of three-dimensional multi-layered microstructures using a scanning laser system
H. Yu#, B. Li#, **X. Zhang***
Sensors and Actuators A: Physical, 2006, 125(2): 553-564

[31]. Cellular mechanics study in cardiac myocytes using PDMS pillars array
Y. Zhao# and **X. Zhang***
Sensors and Actuators A: Physical, 2006, 125(2): 398-404

[30]. Adaptation of flexible polymer fabrication to cellular mechanics study
Y. Zhao# and **X. Zhang***
Applied Physics Letters, 2005, 87(14): 144101

[29]. Cellular force measurements using single-spaced polymeric microstructures: isolating cells from base substrate
Y. Zhao#, C.C. Lim, D.B. Sawyer, R. Liao, **X. Zhang***
Journal of Micromechanics and Microengineering, 2005, 15(9): 1649-1656

[28]. Microbridge testing of plasma-enhanced chemical-vapor deposited silicon oxide films on silicon wafers
Z. Cao#, T-Y Zhang, **X. Zhang***
Journal of Applied Physics, 2005, 97(10): 104909

[27]. High-speed microfabricated silicon turbomachinery and fluid film bearings
L.G. Frechette, S.A. Jacobson, K.S. Breuer, F.F. Ehrich, R. Ghodssi, R. Khanna, C.W. Wong, **X. Zhang**, M.A. Schmidt, A.H. Epstein
Journal of Microelectromechanical Systems, 2005, 14(1): 141-152

[26]. Building embedded microchannels using a single layered SU-8, and determining Young's modulus using a laser acoustic technique
H. Yu#, O. Balogun, B. Li#, T.W. Murray, **X. Zhang***
Journal of Micromechanics and Microengineering, 2004, 14(11): 1576-1584

[25]. Density change and viscous flow during structural relaxation of plasma-enhanced chemical-vapor-deposited silicon oxide films
Z. Cao# and **X. Zhang***
Journal of Applied Physics, 2004, 96(8): 4273-4280

[24]. Pumping capacity and reliability of cryogenic micro-pump for micro-satellite applications
X. Zhang*, Y. Zhao#, B. Li#, D. Ludlow#

Journal of Micromechanics and Microengineering, 2004, 14(10): 1421-1429

[23]. Rapid three-dimensional manufacturing of microfluidic structures using a scanning laser system
B. Li#, H. Yu#, A. Sharon, **X. Zhang***
Applied Physics Letters, 2004, 85(12): 2426-2428

[22]. A self-acting gas thrust bearing for high-speed microrotors
C.W. Wong, **X. Zhang**, S.A. Jacobson, A.H. Epstein
Journal of Microelectromechanical Systems, 2004, 13(2): 158-164

[21]. Strain analysis in MEMS/NEMS structures and devices by using focused ion beam system
B. Li#, X. Tang, H. Xie, **X. Zhang***
Sensors and Actuators A: Physical, 2004, 111(1): 57-62

[20]. High power density silicon combustion systems for micro gas turbine engines
C.M. Spadaccini, A. Mehra, J. Lee, **X. Zhang**, S. Lukachko, I.A. Waitz
Journal of Engineering for Gas Turbines and Power, 2003, 125(3): 709-719

[19]. Intrinsic stress generation and relaxation of plasma-enhanced chemical vapor deposited oxide during deposition and subsequent thermal cycling
K-S Chen, **X. Zhang**, S-Y Lin
Thin Solid Films, 2003, 434(1-2): 190-202

[18]. Enhancement of rotordynamic performance of high-speed micro-rotors for power MEMS applications by precision deep reactive ion etching
N. Miki, C.J. Teo, L. Ho, **X. Zhang**
Sensors and Actuators A: Physical, 2003, 104(3): 263-267

[17]. Igniters and temperature sensors for a micro-scale combustion system
X. Zhang, A. Mehra, A.A. Ayon, I.A. Waitz
Sensors and Actuators A: Physical, 2003, 103(1-2): 253-262

[16]. Characterization of silicon wafer bonding for Power MEMS applications
A.A. Ayon, **X. Zhang**, K. Turner, D. Choi, B. Miller, S.F. Nagle, S.M. Spearing
Sensors and Actuators A: Physical, 2003, 103(1-2): 1-8

[15]. Preliminary development of a hydrocarbon-fueled catalytic micro-combustor
C.M. Spadaccini, **X. Zhang**, C.P. Cadou, N. Miki, I.A. Waitz
Sensors and Actuators A: Physical, 2003, 103(1-2): 219-224

[14]. Thermo-mechanical behavior of thick PECVD oxide films for power MEMS applications
X. Zhang* K-S Chen, S.M. Spearing
Sensors and Actuators A: Physical, 2003, 103(1-2): 263-270

[13]. Multi-stack silicon-direct wafer bonding for 3D MEMS manufacturing
N. Miki, **X. Zhang**, R. Khanna, A.A. Ayon, D. Ward, S.M. Spearing
Sensors and Actuators A: Physical, 2003, 103(1-2): 194-201

[12]. Effect of process parameters on the surface morphology and mechanical performance of silicon structures after deep reactive ion etching (DRIE)

K-S Chen, A.A. Ayon, **X. Zhang**, S.M. Spearing
Journal of Microelectromechanical Systems, 2002, 11(3): 264-275

[11]. Anisotropic silicon trenches 300–500 μm deep employing time multiplexed deep etching (TMDE)
A.A. Ayon, **X. Zhang**, R. Khanna
Sensors and Actuators A: Physical, 2001, 91(3): 381-385.

[10]. Residual stress and fracture in thick tetraethylorthosilicate (TEOS) and silane-based PECVD oxide films
X. Zhang, K-S Chen, R. Ghodssi, A.A. Ayon, S.M. Spearing
Sensors and Actuators A: Physical, 2001, 91(3): 373-380

[9]. A six-wafer combustion system for a silicon micro gas turbine engine
A. Mehra, **X. Zhang**, A.A. Ayon, I.A. Waitz, M.A. Schmidt, C.M. Spadaccini
Journal of Microelectromechanical Systems, 2000, 9(4): 517-527.

[8]. Through-wafer electrical interconnect for multilevel microelectromechanical system devices
A. Mehra, **X. Zhang**, A.A. Ayon, I.A. Waitz, M.A. Schmidt
Journal of Vacuum Science & Technology B, 2000, 18(5): 2583-2589

[7]. Micro-Raman spectral analysis of the subsurface damage layer in machined silicon wafers
L-Q Chen, **X. Zhang**, T-Y Zhang, H.Y. Lin, S.B. Lee
Journal of Materials Research, 15(7): 1441-1444

[6]. Rapid thermal annealing of polysilicon thin films
X. Zhang, T-Y Zhang, M. Wong, Y. Zohar
Journal of Microelectromechanical Systems, 7(4): 356-364

[5]. Measurements of residual stresses in thin films using micro-rotating-structures
X. Zhang, T-Y Zhang, Y. Zohar
Thin Solid Films, 1998, 335(1-2): 97-105

[4]. Buckling of polysilicon microbeams during sacrificial layer removal
T-Y Zhang, **X. Zhang**, Y. Zohar
Journal of Micromechanics and Microengineering, 8(3): 243-249

[3]. Residual-stress relaxation in polysilicon thin films by high-temperature rapid thermal annealing
X. Zhang, T-Y Zhang, M. Wong, Y. Zohar
Sensors and Actuators A: Physical, 64(1): 109-115

[2]. Investigation on the 1000, 1150 and 1400 °C isothermal section of the Ti-Al-Nb system
G.L. Chen, X.T. Wang, K.Q. Ni, S.M. Hao, J.X. Cao, J.J. Ding, **X. Zhang**
Intermetallics, 4(1): 13-22

[1]. Calculation of phase equilibria for the ternary system by the grand potential method
S.M. Hao and **X. Zhang**
Journal of Phase Equilibria, 16(5): 441-446