

# Ruitao Su

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## Education

<b>PhD in Mechanical Engineering</b> , University of Minnesota	<b>Oct. 30, 2020</b>
<b>MS in Mechanical Engineering</b> , University of Cincinnati	<b>2015</b>
<b>BS in Mechanical Engineering</b> , Huazhong University of Science and Technology	<b>2013</b>

## Postdoctoral Training

<b>Postdoc in Computer Science and Artificial Intelligence Lab</b> , MIT	<b>2021 - Present</b>
○ Advisor: Wojciech Matusik	
<b>Postdoc in Mechanical Engineering</b> , University of Minnesota	<b>2020 - 2021</b>
○ Advisor: Michael C. McAlpine	

## Publications

### Journal Articles

- **R. Su**, G. Haghighashtiani, M. C. McAlpine, Advances in Materials, Integration, and Functionalities of 3D Printed Microfluidics, *Lab on a Chip* (2022) [Review paper under preparation]
- **R. Su\*** (co-first), S. H. Park\* (co-first), X. Ouyang, S. I. Ahn, M. C. McAlpine, 3D Printed Flexible Organic Light-Emitting Diode Displays, *Science Advances* **7**, eabl8798 (2022) [Accepted]
- **R. Su**, J. Wen, Q. Su, M. S. Wiederoder, S. J. Koester, J. R. Uzarski, M. C. McAlpine, 3D Printed Self-Supporting Elastomeric Structures for Multifunctional Microfluidics, *Science Advances* **6**, eabc9846 (2020)
- S. H. Park\* (co-first), **R. Su\*** (co-first), J. Jeong, S.-Z. Guo, K. Qiu, D. Joung, F. Meng, M. C. McAlpine, 3D Printed Polymer Photodetectors. *Advanced Materials* **30**, 1803980 (2018)
  - Highlighted: *Nature* (2018). DOI: 10.1038/d41586-018-06193-8
- K. Qiu, Z. Zhao, G. Haghighashtiani, S.-Z. Guo, M. He, **R. Su**, Z. Zhu, D. Bhuiyan, P. Murugan, F. Meng, S. H. Park, C.-C. Chu, B. M. Ogle, D. A. Saltzman, B. R. Konety, R. M. Sweet, M. C. McAlpine, 3D Printed Organ Models with Physical Properties of Tissue and Integrated Sensors. *Advanced Materials Technologies* **3**, 1700235 (2017)
- G. Hou, D. Chauhan, V. Ng, C. Xu, Z. Yin, M. Paine, **R. Su**, V. Shanov, D. Mast, M. Schulz, Y. Liu, Gas Phase Pyrolysis Synthesis of Carbon Nanotubes at High Temperature. *Materials and Design* **132**, 112-118 (2017)
- G. Hou, **R. Su**, A. Wang, V. Ng, W. Li, Y. Song, L. Zhang, M. Sundaram, V. Shanov, D. Mast, D. Lashmore, M. Mark, Y. Liu, The effect of a convection vortex on sock formation in the floating catalyst method for carbon nanotube synthesis. *Carbon* **102**, 513–519, (2016)

### Book Chapters

- **R. Su**, S. H. Park, Z. Li, M. C. McAlpine, “3D Printed Electronic Materials and Devices,” in Robotic Systems and Autonomous Platforms: Advances in Materials and Manufacturing. Eds: S. M. Walsh, M. S. Strano. CH 13 (Woodhead, Cambridge, 2019)

### Conference Proceedings

- J. R. Uzarski, M. S. Wiederoder, C. Luckhardt, R. Paffenroth, **R. Su**, M. C. McAlpine, Novel data science driven chemical and biological agent sensors: towards better discrimination in complex environments, *18th International Meeting on Chemical Sensors*, Montreal, Canada (2020)

### Press Articles

- “How microfluidics can automate drug discovery and development”, *Drug Target and Review*, May 2021

- “3D printing and the path to next generation optoelectronics”, *Queen Elizabeth Prize for Engineering*, June 2019

## Patents

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- M. C. McAlpine, **R. Su**, S. H. Park, “Organic Light-Emitting Diode (OLED) Display and Methods of Fabrication Using A Multimodal Three-Dimensional (3D) Printing Technique,” US Provisional Patent Application 63/247,358.
- M. C. McAlpine, **R. Su**, S. J. Koester, J. R. Uzarski, “Additively Manufactured Self-Supporting Microfluidics,” U.S. Patent Application 16/951,794. International Patent Application PCT/US2020/061072.
- E. Crist, D. K. Wood, **R. Su**, M. C. McAlpine, “Three-Dimensional Microfluidic Metastasis Array,” U.S. Provisional Patent Application 63/201,276.

## Presentations

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### Talks

- “3D Printed Flexible Organic Light Emitting Diode Displays” **Dec. 2021**  
*Presentation in Materials Research Society (Boston, MA)*
- “3D Printed Microfluidics with Applications in Drug Screening and Oncology Research” **Sep. 2021**  
*Invited talk on the “6<sup>th</sup> Annual 3D Tissue Models Summit” (Boston, MA)*
- “3D Printed Self-Supporting Elastomeric Microfluidics with Yield-Stress Polymers” **May 2021**  
*Invited seminar presentation at Korea Institute of Industrial Technology (Online)*
- “3D Printing Functional Materials for the Next-Generation Optoelectronic & Microfluidic Devices” **Dec. 2020**  
*Invited talk at the 9<sup>th</sup> East Lake International Forum for Outstanding Overseas Young Scholars (Online)*
- “3D Printed Multifunctional Devices for Biomedical Applications” **Nov. 2020**  
*Lightning/flash live talk in Materials Research Society (Online)*
- “3D Printed Self-Supporting Elastomeric Structures for Multifunctional Microfluidics” **Nov. 2020**  
*Presentation in Materials Research Society (Online)*
- “3D Printed Polymer Photodetector” **Nov. 2018**  
*Presentation in Materials Research Society (Boston, MA)*

### Posters

- “3D Printed LED and Photodetectors” **July 2019**  
*Poster on Purdue Mi-Bio Summit on Flexible and Stretchable Bioelectronics (West Lafayette, IN)*
- “3D Printed Silicon Nanocrystal LED” **Mar. 2017**  
*Poster on NSF MnDRIVE Symposium (Minneapolis, MN)*

## Awards

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- Best Dissertation Award** **Apr. 2021**  
Department of Mechanical Engineering of UMN
- MRS Best Presentation Award** **Dec. 2020**  
Material Research Society, Additive Manufacturing Symposium
- MRS Graduate Student Silver Award** **Nov. 2018**  
Material Research Society (<https://www.mrs.org/gsa-past>)
- University of Minnesota Graduate Fellowship** **2015 - 2016**  
Department of Mechanical Engineering of UMN
- Outstanding Research Award** **July 2015**  
Nanoworld Lab of UC
- University Graduate Scholarship** **Sept. 2013 - Apr. 2015**  
University of Cincinnati

<b>Excellent Study Scholarship</b> Mechanical School of HUST	<b>Dec. 2011</b>
<b>National Encouragement Scholarship</b> Ministry of Education of the People's Republic of China	<b>Oct. 2010</b>
<b>Excellent Freshman Study Scholarship</b> Mechanical School of HUST	<b>Apr. 2010</b>

## Mentoring & Teaching

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- **Student mentorship**
  - 2017 Summer NSF MRSEC undergrad research program: Nicholas Fuhr (PhD, Boston University)
- **Guest lecturer**
  - PHYS 491: Introduction to Nanoscience (2021 Fall, Virginia Commonwealth University)
  - MECH 492/892-012: Biofabrication (2021 Spring, University of Nebraska-Lincoln)
  - ME 8255: Introduction to Nanotechnology (2019 Fall, University of Minnesota)
- **Teaching assistant**
  - Vibration Engineering (University of Minnesota)
  - Kinematics and Kinetics of Machines (University of Cincinnati), Structural Mechanics (University of Cincinnati), Engineering Economics (University of Cincinnati)

## Academic Services

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- **Journal editorial boards**
  - *Micromachines*, Topic Editor
- **Grant reviewer**
  - Conference travel grants, Grad Student Council of University of Minnesota (May 2020)
- **Journal reviewer**
  - *Nature Communications*, *MRS Advances*, *Journal of Materials Chemistry C*, *ACS Applied Materials & Interfaces*, *npj Flexible Electronics*, *PLOS ONE*

## Leadership

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- **Lab safety officer** of the McAlpine Research Lab **2017 – 2020**
  - Coordinated execution of research protocols for lab safety
  - Conducted annual lab-specific safety training
- **Secretary** of ME Grad Student Council, University of Minnesota **2017 – 2019**
  - Assisted in departmental recruitment visiting of graduate students
- **Volunteer supervisor** of Great River Greening **Mar. - Aug. 2017**
  - Mentored monthly on-site work for natural habitats improvement, studied ecological conditions of rivers & forests

## Research

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**McAlpine Research Group** (University of Minnesota) **Sept. 2015 – Present**

*Advisor: Michael C. McAlpine*

- **Multimodal 3D printed light emitting diode (LED) displays**
  - Designed a multimodal and multi-material method to fully 3D print individually-addressable LED displays
  - Realized cathode and interconnects printing at room temperature utilizing mechanical reconfiguration of liquid metal
  - Improved pixel brightness and lifetime by optimizing emissive layer uniformity with spray printing
- **3D printed self-supporting and elastomeric microfluidics**
  - Invented a strategy to print self-supporting microfluidic structures by extruding yield-stress viscoelastic inks

- Created the methods to print multifunctional components, including mixers, valves, and pumps
- Created the methodology to directly print microfluidic networks on micro sensors and curvilinear surfaces
- **3D printed polymer photodetectors (PDs)**
  - Optimized thickness of 3D printed photoactive film, achieving a commercial-level quantum efficiency of 25.3%
  - Integrated PD arrays on curvilinear surfaces for spherical image sensing and bionic eyes
  - Created a method to print multifunctional optoelectronic circuits by integrating PD & LED in a side-by-side layout
- **Red-IR LEDs printed with silicon nanocrystals (SiNCs)**
  - Printed biocompatible nano particles, SiNCs, as the emissive layer of LEDs and acquired RED-IR electroluminescence

**Nanoworld Lab** (University of Cincinnati)

**Dec. 2013 - July 2015**

*Advisor: Mark J. Schulz*

- **Carbon nanotube (CNT) synthesis via floating catalyst chemical vapor deposition (CVD)**
  - Investigated precursor compositions to improve the electrical and mechanical properties of CNTs
  - Created methods to on-the-fly spin CNT yarns and sheets from the as-synthesized CNT aerogel assembly

**National Numerical Control Research Center**

**May - Sept. 2012**

*Advisor: Bao Song*

- **Position control board for Numerical Control Field Bus**
  - Programmed the position control board utilizing Field Programmable Gate Array (FPGA) language

## **Technical Skills**

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- Characterization: **Confocal microscope, SEM, AFM, Raman Spectroscopy**
- Finite element analysis (FEA): **COMSOL, Ansys**
- Computer aided design (CAD): **Solidworks, Auto CAD**
- Programming and data science: **Matlab, Python & C++**

## **Press Report**

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- “How microfluidics can automate drug discovery and development,” Drug Target Review, May 2021
- “3D printing microfluidic channels for medical testing,” National Academy of Engineering Frontier of Engineering, Jan. 2021
- “Researchers 3D print unique micro-scale fluid channels used for medical testing,” Tech. Networks, Oct. 2020
- “Interview: how the US Army’s scientists are 3D printing cyberpunk-style biological sensors,” 3D Printing Industry, Nov. 2020
- “Eyes, wasps and asteroid dust — August’s best science images,” Nature News, Sep. 2018
- “12 innovations that will revolutionize the future of medicine,” National Geographic, Dec. 2018