Ruitao Su

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Education

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

Postdoctoral Training

Postdoc in Computer Science and Artificial Intelligence Lab, MIT   **2021 - Present**
- o   Advisor: Wojciech Matusik

Postdoc in Mechanical Engineering, University of Minnesota   **2020 - 2021**
- o   Advisor: Michael C. McAlpine

Publications

Journal Articles

➢ **R. Su**, G. Haghiashtiani, 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**, abl8798 (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. Haghiashtiani, 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

➢ 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

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 "6th 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 9th 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

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

Excellent Study Scholarship   **Dec. 2011**
Mechanical School of HUST

National Encouragement Scholarship   **Oct. 2010**
Ministry of Education of the People's Republic of China

Excellent Freshman Study Scholarship   **Apr. 2010**
Mechanical School of HUST

Mentoring & Teaching

➢ **Student mentorship**
- o 2017 Summer NSF MRSEC undergrad research program: Nicholas Fuhr (PhD, Boston University)

➢ **Guest lecturer**
- o PHYS 491: Introduction to Nanoscience (2021 Fall, Virginia Commonwealth University)
- o MECH 492/892-012: Biofabrication (2021 Spring, University of Nebraska-Lincoln)
- o ME 8255: Introduction to Nanotechnology (2019 Fall, University of Minnesota)

➢ **Teaching assistant**
- o Vibration Engineering (University of Minnesota)
- o Kinematics and Kinetics of Machines (University of Cincinnati), Structural Mechanics (University of Cincinnati), Engineering Economics (University of Cincinnati)

Academic Services

➢ **Journal editorial boards**
- o *Micromachines*, Topic Editor

➢ **Grant reviewer**
- o Conference travel grants, Grad Student Council of University of Minnesota (May 2020)

➢ **Journal reviewer**
- o *Nature Communications, MRS Advances, Journal of Materials Chemistry C, ACS Applied Materials & Interfaces, npj Flexible Electronics, PLOS ONE*

Leadership

➢ **Lab safety officer** of the McAlpine Research Lab   **2017 – 2020**
- o Coordinated execution of research protocols for lab safety
- o Conducted annual lab-specific safety training

➢ **Secretary** of ME Grad Student Council, University of Minnesota   **2017 – 2019**
- o Assisted in departmental recruitment visiting of graduate students

➢ **Volunteer supervisor** of Great River Greening   **Mar. - Aug. 2017**
- o Mentored monthly on-site work for natural habitats improvement, studied ecological conditions of rivers & forests

Research

McAlpine Research Group (University of Minnesota)   **Sept. 2015 – Present**
Advisor: Michael C. McAlpine

➢ **Multimodal 3D printed light emitting diode (LED) displays**
- o Designed a multimodal and multi-material method to fully 3D print individually-addressable LED displays
- o Realized cathode and interconnects printing at room temperature utilizing mechanical reconfiguration of liquid metal
- o Improved pixel brightness and lifetime by optimizing emissive layer uniformity with spray printing

➢ **3D printed self-supporting and elastomeric microfluidics**
- o Invented a strategy to print self-supporting microfluidic structures by extruding yield-stress viscoelastic inks

- o Created the methods to print multifunctional components, including mixers, valves, and pumps
- o Created the methodology to directly print microfluidic networks on micro sensors and curvilinear surfaces

➢ **3D printed polymer photodetectors (PDs)**
- o Optimized thickness of 3D printed photoactive film, achieving a commercial-level quantum efficiency of 25.3%
- o Integrated PD arrays on curvilinear surfaces for spherical image sensing and bionic eyes
- o 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)**
- o 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)**
- o Investigated precursor compositions to improve the electrical and mechanical properties of CNTs
- o 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**
- o Programmed the position control board utilizing Field Programmable Gate Array (FPGA) language

Technical Skills

➢ 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

➢ "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