

Fufei An

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EDUCATION

University of Illinois at Urbana-Champaign (UIUC)	Aug. 2018 - May. 2024
<i>Ph.D Candidate of Materials Science and Engineering</i>	<i>Advisor: Qing Cao</i>
Shanghai Jiao Tong University (SJTU)	Sep. 2014 - Jun. 2018
<i>Bachelor of Engineering in Materials Science and Engineering</i>	<i>Advisor: Shenmin Zhu</i>

RESEARCH INTEREST

My Research mainly primarily revolves around **nanomaterial synthesis** and **nanoelectronics fabrication**, including low-dimensional materials for **transistors** and **memory** devices, **GaN-based LED** arrays for optogenetics research with neural cells, **solution-processed electronics** for fundamental logic computations, etc. These experiences has solidified my expertise in the fundamental aspects of **semiconductor device physics**, encompassing a wide range of components.

SKILLS

Fabrication Skills: Familiar with all the common fabrication processes for nanoelectronics, including (but not limited) Photolithography (Both traditional mask manual aligner and Heidelberg Maskless Aligner), Electron Beam Lithography (heavy user on both Raith system and Elionix system), Wet etching with HF/BOE/TMAH etc. and dry etching like Reactive Ion Etching (RIE) and Plasma enhanced ICP-RIE, Wet/Dry Oxidation, Metal depositions (E-beam evaporator, AJA sputtering system, thermal evaporator, etc.), Atomic Layer Deposition (ALD), Plasma-Enhanced Chemical Vapor Deposition (PECVD), etc.

Materials Characterizations and Measurements: Nanophoton Raman, Atomic Force Microscope (Cypher AFM), Scanning Electron Microscope (Hitachi SEM), Focused Ion Beam (Thermo Scios2 Dual-Beam SEM/FIB), Thermal Gravity Analysis (TGA), X-Ray Diffraction (XRD), X-ray photoelectron spectroscopy (XPS), Fourier Transform Infrared Spectroscopy (FTIR), Transmission Electron Microscope (TEM), Scanning transmission electron microscopy (STEM), Micromanipulator Probe Station (Keysight EasyExpert as the software), CRX-6.5K Probe Station, CHI650D (Electrochemical Workstation), Brunauer, Emmett and Teller (BET) Technique, Gas Chromatograph, etc.

Computer Competencies: OriginLab, Adobe Photoshop, Matlab, Python, LabVIEW, Blender, Klayout, DigitalMicrograph, Solidworks, Microsoft, etc.

SELECTED AWARDS

Mavis Future Faculty Fellows by the Grainger College of Engineering (2023-2024)	<i>Apr.2023</i>
PPG-MRL Graduate Research Assistantship at the Materials Research Laboratory	<i>Dec.2021</i>
The Chun-Tsung Scholar in Shanghai Jiao Tong University	<i>Jun.2018</i>
Undergraduate Overseas Research Scholarship	<i>Oct.2017</i>
Suzhou Yucai Scholarship	<i>Sep.2017</i>
Prominent Performance Award for Academic Conference of Chun-Tsung Program	<i>Dec.2016</i>
Arawana Scholarship, Awarded by Arawana Charity Foundation	<i>Sep.2016</i>
Second Prize, Contemporary Undergraduate Mathematical Contest in Modeling	<i>Sep.2016</i>
Elite (Liu Yongling) Scholarship, Awarded by Elite Industrial Holdings Ltd.	<i>Sep.2015</i>

PUBLICATIONS

- **F.An**, C.Wang, V.H.Pham, A.Borisevich, J.Qian, K.Yin, S.Pidaparth, B.Robinson, A-S.Chou, J.Lee, J.Weidman, S.Natesakhawat, H.Wang, A.Schleife, J-M.Zuo, C.Matranga, and Q.Cao*. Ultrathin quasi-2D amorphous carbon dielectric prepared from solution precursor for nano-electronics. *Communications Engineering* 2, 93 (2023).
- J.Cui, **F.An**, J.Qian, Y.Wu, L.L. Sloan, S.Pidaparth, J-M.Zuo, Q.Cao*. CMOS-Compatible and Scalable Electrochemical Synaptic Transistor Arrays for Deep-Learning Accelerator. *Nature Electronics*. 6, 292–300 (2023).
- Y.Zhang, J.Cui, K-Y.Chen, SH. Kuo, J.Sharma, R.Bhatta, Z.Liu, A.E-Mohr, **F.An**, J.Li, Q.Chen, K.D.Foss, H.Wang, Y.Li, A.M.McCoy, G.W.Lau, Q.Cao*. A Smart Coating with Integrated Physical-Antimicrobial and Strain-Mapping Functionalities for Orthopaedic Implants. *Science Advances*. 9, eadg7393 (2023).
- Y.Xu^a, G.Zhao^a, L.Zhu, Q.Fei, Z.Zhang, Z.Chen, **F.An**, Y.Chen, Y.Ling, P.Guo, S.Ding, G.Huang, P-Y.Chen, Q.Cao, Z.Yan*. Pencil-paper on-skin electronics. *Proceedings of the National Academy of Sciences* 117-31(2020):18292-18301.
- L.Yao^a, **F.An**^a, H.Wu, S.Zhu*, C.Lin, M.Xia, K.Xue, D.Zhang, and K.Lian**. A NiCo₂S₄/hierarchical porous carbon for high performance asymmetrical supercapacitor. *Journal of Power Sources* 427(2019): 138-144.
- S.Du^a, Y.Wang^a, K.J-T.Livi, C.Wang, R.Luo, Z.Zhang, H.Alghamdi, C.Li, **F.An**, B.Gaskey, T.Muel-ler, and A.S.Hall*. Ordered Intermetallic Pd₃Bi Prepared by an Electrochemically Induced Phase Transformation for Oxygen Reduction Electrocatalysis. *ACS nano* 13, no.9(2019): 10818-10825.
- L.Yao^a, M.Xia^a, **F.An**, N.Ma, X.Jiang, S.Zhu*, D.Wang, and J.Ma*. Superior removal of Hg (II) ions from wastewater using hierarchically porous, functionalized carbon. *Journal of hazardous materials* 371(2019): 33-41.

PATENT APPLICATIONS

- Q.Cao, **F.An**, C.Matranga, C.Wang, V.H.Pham. "2D amorphous carbon film assembled from graphene quantum dots" *U.S. Patent Application No.17/707,521*

PRESENTATIONS

- C.Wang, V.H.Pham, **F.An**, C.Matranga, Q.Cao. Solution Processible Carbon Precursors for 2D Amorphous Carbon Dielectric. *The Materials Science & Technology (MS&T) technical meeting and exhibition (2022)*

TEACHING EXPERIENCES

MSE 304 Electronic Properties of Materials

By Prof. Andre Schleife

Teaching Assistant

UIUC, Spring 2020

- Contributed to the development of a comprehensive question database hosted on the course's GitHub platform. This resource was made available to students to facilitate their practice and self-assessment
- Provided weekly office hours to offer assistance to students who required further support

MSE 403 Synthesis of Materials

By Prof. Qing Cao

Teaching Assistant

UIUC, Fall 2020

- Assisted by conducting office hours to provide support to students in need
- Responsible for grading both the course homework assignments and the tests

RESEARCH PROJECTS

Atomically Thin Amorphous Carbon

Advisor: Qing Cao

- Developed a new strategy for preparing ultrathin amorphous carbon on wafer scale with precisely controlled film thickness from monolayers to multilayers
- Characterized the physical and electrical properties of the film showing great potential as an exceptional dielectric for nano-electronic devices
- Demonstrated applications including 2D-material-based transistors and memristors which showed promising performance and uniformity

Electrochemical Synaptic Transistor Arrays

Advisor: Qing Cao

- Presented an electrochemical synaptic transistor, built with CMOS compatible metal oxides and operating by shuffling protons within a symmetric gate stack
- Monolithically integrated the transistor with silicon transistors to form pseudo-crossbar arrays where parallel, precise, and symmetric programming of the channel conductance can be executed with gate-voltage pulses
- High-speed programming with frequency approaching megahertz, endurance above 100 million read-write pulses, and device critical dimensions down to 150×150 nm² have all been realized

Solution-Processed/Printable Cu-In-Se Based Electronics

Advisor: Qing Cao

- Developed scalable solution process for high-performance and operationally stable Cu-In-Se (CIS) thin film under low processing temperature
- Implemented the CIS film into transistors and explored the applications by further integrating the CIS transistors with carbon-nanotube transistors and GaN light-emitting diode into logic circuits as demonstrations

Synthetic Neurocomputers

Advisor: Qing Cao

- Electronic and optoelectronic devices (transfer-printing GaN LED arrays) will be integrated with each neural cell to administer and monitor the neuronal and synaptic activities based on electrophysiology, optogenetics, and neurochemistry
- The fabricated neurocomputer prototype will then be utilized to perform various learning and computing tasks such as image recognition and space navigation.

Pd-based Intermetallics for Electrocatalysis

Advisor: Anthony Shoji Hall

- Utilized a wet chemistry method to synthesize pure Pd-based intermetallic nanocrystals, characterized and analyzed the morphology of as-obtained nanocrystals, and studied the mechanism of the size and phase control
- Tested the electrocatalytic activity of those intermetallics

Hierarchical NiCo₂S₄/Carbon for Supercapacitor

Advisor: Shenmin Zhu

- Utilized one-step hydrothermal method to synthesize NiCo₂S₄/Carbon composites
- Designed and assembled the synthesized NiCo₂S₄/Carbon composite into an asymmetrical supercapacitor, showing high energy density, high power density and excellent cycling stability