# Di Wu

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## Summary


**An interdisciplinary researcher with extensive background in semiconductor devices and instrument construction.**

- ⋆ 8+ years' experience in semiconductor device fabrication and characterizations using cleanroom facilities.
- ⋆ Extensive experience in chemical vapor deposition system for thin film and nanomaterial growth.
- ⋆ 5+ year' expertise in scanning probe microscopy for electrical property measurement.
- ⋆ Rich experience in instrument design, construction, programming and troubleshooting.
- ⋆ 4 years' expertise in theoretical model and numerical simulation of nanoscale devices.
- ⋆ Hands-on experience in RF circuit design and testing.
- ⋆ Strong commitment to team environment with the ability to work independently.


## Experimental Skills

Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic Force microscopy (AFM), Microwave impedance microscopy (MIM), Photolithography, E-beam lithography, Chemical vapor deposition (CVD), Reactive-ion etching (RIE), Metal deposition system, Thermal oxidation, Semiconductor transport measurements, etc.

## Software Engineering Skills

Python, C/C++, Matlab, Labview, Windows and Linux OSes, Graphical User Interface (GUI), Data Visualization, Database (SQL), etc.

## Professional Experiences

**Research Scientist** at University of Texas at Austin — Sep. 2018- present

- ➢ Designed and fabricated $MoS_2$/$WSe_2$ van der Waals heterostructure transistors with anti-bipolar transfer characteristics.
- ➢ Quantitatively imaged the local conductance of the heterostructure transistors by microwave impedance microscopy, and revealed the microscopic origin of novel transport behaviors.
- ➢ Pioneered in imaging intrinsic photoconductivity of two-dimensional semiconductors at nano-scale.
- ➢ Published 2 peer-reviewed papers.

**Postdoctoral Fellow** at the University of Texas at Austin — Jun. 2013- Aug. 2018

- ➢ **Nano-device fabrication and electrical property measurements on two-dimensional semiconductors**
  - ⋆ Constructed two low-pressure chemical vapor deposition (LPCVD) systems for the growth of two-dimensional semiconductors ($MoS_2$, $WSe_2$, black phosphorene, *etc*.).
  - ⋆ Fabricated field effect transistors based on 2D semiconductors with high carrier mobility in clean room.
  - ⋆ Invented memory devices based on $MoS_2$ monolayers and 2D ferroelectrics ($In_2Se_3$).
  - ⋆ Quantitatively imaged the potential landscape of working transistors and uncovered the edges states experimentally for the first time by microwave impedance microscopy.
  - ⋆ Designed dozens of photomasks using AutoCAD and L-Edit for device fabrication using photolithography and electron-beam lithography.
  - ⋆ Published 9 peer-reviewed papers.
- ➢ **Scientific instrumentation (Hardware Programming)**
  - ⋆ Developed a Python package which facilitates designing and managing experiments through computer, featuring layered architecture of experiment and OOP instrument control.

⋆ Developed GUI for AFM systems, capable of experiment condition monitoring, automatic data accusation, full software-based control of all parts.

- **Mathematical modeling and computational solutions**
  - ⋆ Modeled the problem of impedance match in microwave engineering and developed a program for arbitrary microwave circuit optimization with result visualization, now a fundamental and easy-to-use tool in the lab.
  - ⋆ Performed experimental data analysis and image processing such as interpolation/extrapolation, fitting, filtering, noise cancelation through Python modules and customized codes.
- **Environmental health & safety assistant**
  - ⋆ In charge of the lab safety including chemical inventory, recycling and safety training.
- **Teaching experience**
  - ⋆ Lecture Guest for electrical engineering graduate Course EE396V

**Research Assistant** at Peking University Sep. 2008- Sep. 2013

- **Synthesis and property measurements on carbon nanotube and graphene**
  - ⋆ Developed a chemical vapor deposition (CVD) method to grow single-crystal graphene p-n junctions.
  - ⋆ Built a photocurrent measurement platform for optoelectronic devices.
  - ⋆ Published 11 peer-reviewed papers and applied 2 patent.
- **Teaching experience**
  - ⋆ Supervised groups of 30 students doing analytic chemistry and organic chemistry experiments.

## Education

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| **Postdoctoral Fellow in Physics** | The **University of Texas at Austin,** Texas, US | Aug., 2018 |
| **Ph. D. in Physical Chemistry** | **Peking University,** Beijing, China | Jun., 2013 |
| | Dissertation: Preparation of mosaic graphene with p-n junctions and investigation of its optoelectronic properties | |
| **B. S. in Physical Chemistry** | **Peking University,** Beijing, China | Jun., 2008 |

## Awards and Honors

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| ⋆ Nano-star Scholarship | Center for Nanochemistry | 2012 |
| ⋆ Bruker Nano Scholarship | Bruker Corporation | 2012 |
| ⋆ Zhong Chen Yulan Scholarship | Peking University | 2012 |

## Patents

1. Zhongfan Liu, Kai Yan, Di Wu and Hailin Peng, "Growth of single-crystalline graphene p-n junctions in a large scale," Chinese Patent, Serials NO. 201210450582.4
2. Zhongfan Liu, Guoming Zhang, Di Wu and Liying Jiao, "**Patterning** carbon nanotube films or arrays by photo-catalytic oxidation," Chinese Patent, Serials NO. 200910092603.8

## Publications (Selected)

1. Y. Zhou†, D. Wu† (†equal contribution), Y. Zhu, Y. Cho, Q. He, X. Yang, K. Herrera, Z. Chu, Y. Han, M. C. Downer, H. Peng and K. Lai, "Out-of-plane Piezoelectricity and Ferroelectricity in Layered *α*-$In_2Se_3$ Nano-flakes," Nano Letters, 2017, *17*, 5508–5513.
2. D. Wu, X. Li, L. Luan, X. Wu, W. Li, M. N. Yogeesh, R. Ghosh, Z. Chu, D. Akinwande, Q. Niu, K. Lai, "Uncovering Edge States and Electrical Inhomogeneity in $MoS_2$ Field Effect Transistors," Proceedings of the National Academy of Sciences, 2016, *133*, 8583-8588.
3. D. Wu, A. J. Pak, Y. Liu, Y. Zhou, X. Wu, Y. Zhu, M. Lin, H. Peng, Y. Ren, Y.-H. Tsai, G. S. Hwang and K. Lai, "Thickness-Dependent Dielectric Constant of Few-Layer $In_2Se_3$ Nanoflakes," Nano Letters, 2015, *15*, 8136–8140.
4. D. Wu, K. Yan, Y. Zhou, H. Peng and Z. Liu, "Plasmon Enhanced Photothermoelectric Conversion in Chemical Vapor Deposited Graphene p-n Junctions," Journal of the American Chemical Society, 2013, *135*, 10926-10929.

5. K. Yan†, D. Wu† (†equal contribution), H. Peng, L. Jin, Q. Fu, X. Bao and Z. Liu, "Modulation-Doped Growth of Mosaic Graphene with Single-Crystalline p-n Junctions for Efficient Photocurrent Generation," Nature Communications, 2012, *3*, 1280, DOI: 10.1038/ncomms2286. (†equal contribution )
6. B. Li†, L. Zhou†, D. Wu† (†equal contribution), H. Peng†, K. Yan, Y. Zhou and Z. Liu, "Photochemical Chlorination of Graphene," ACS Nano, 2011, *5(7)*, 5957–5961.
7. D. Wu, B. Li, L. Zhou, H. Peng, K. Yan, Y. Zhou and Z. Liu, "Properties of photochlorinated graphene" Nanotechnology Materials and Devices Conference (NMDC), 2011 IEEE DOI: 10.1109/NMDC.2011.6155366
8. Y. Liu, C. Tan, H. Chou, A. Nayak, D. Wu, R. Ghosh, H.-Y. Chang, Y. Hao, X. Wang, J.-S. Kim, R. Piner, R. S. Ruoff, D. Akinwande and K. Lai, "Thermal Oxidation of $WSe_2$ Nanosheets Adhered on $SiO_2$/Si Substrates," Nano Letters, 2015, *15*, 4979-4984.
9. J.-S. Kim, Y. Liu, W. Zhu, S. Kim, D. Wu, L.Tao, A. Dodabalapur, K. Lai and D. Akinwande, "Toward air-stable multilayer phosphorene thin-films and transistors," Scientific Reports, 2015, 5,8989, DOI: 10.1083/srep08989.
10. H. Peng, W. Dang, J. Cao, Y. Chen, D. Wu, W. Zheng, H. Li, Z. X. Shen and Z. Liu, "Topological insulator nanostructures for near-infrared transparent flexible electrodes," Nature Chemistry 2012, *4*, 281–286.

## **Conference Presentations** (Selected)

1. "Out-of-plane Piezoelectricity and Ferroelectricity in Layered *α*-$In_2Se_3$ Nano-flakes," American Physical Society March Meeting, Los Angeles, USA, March 5-9th, **2018**. (Oral)
2. "Nano-imaging of Electrical Properties of $MoSe_2$/$WSe_2$ Vertical Heterostructures," American Physical Society March Meeting, New Orleans, USA, March 13–17th, **2017**. (Oral)
3. "Uncovering Edge States and Electrical Inhomogeneity in MoS2 Field Effect Transistors," American Physical Society March Meeting, Baltimore, USA, March 14-18th, **2016**. (Oral)
4. "Thickness-Dependent Dielectric Constant of Few-Layer In2Se3 Nanoflakes," American Physical Society March Meeting, San Antonio, USA, March 2-6th, **2015**. (Oral)
5. "Electronic Properties of Photochlorinated Graphene," The 18th China-Japan Bilateral Symposium on Intelligent Electrophotonics Materials and Molecular Electronics (SIEMME' 18), Tianjin, China, Sep.16-18th, **2011**. (Oral)

## Scientific Instruments Developed

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| ⋆ Chemical vapor deposition system for growth of two-dimensional layered materials *e.g.*, graphene, $MoS_2$ and $In_2Se_3$ | University of Texas at Austin |
| ⋆ Transfer system for 2D materials in glove box | University of Texas at Austin |
| ⋆ Tuning-fork based cryogenic microwave impedance microscopy | University of Texas at Austin |
| ⋆ Photocurrent and transport measurement system | Peking University |
| ⋆ Photochemical reaction system | Peking University |

# References


✧ **Dr. Keji Lai**

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✧ **Dr. Deji Akinwande**

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