

## Curriculum Vitae

### 1. Personal Information

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Name: Shen Lai

Gender: Male

Email: laishen@um.edu.mo

Research field: device physics of 2D materials



### 2. Academic experiences

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Jun. 2018-Jan. 2022

#### **Research Fellow**

Nanyang Technological University

Advisor: Weibo Gao (<http://www1.spms.ntu.edu.sg/~weibogroup/>)

Sep. 2012-Feb. 2018

#### **Ph.D.** in Nano Engineering

Sungkyunkwan University, Suwon, Korea

Advisor: Sungjoo Lee (<http://ndtl.skku.edu/>)

Sep. 2008-Sep. 2012

#### **B.S.** in Metallic Materials

Department of Materials Science and Engineering,

Dalian University of Technology, Dalian, China

### 3. Research Experiences

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- Discovered third-order nonlinear Hall effect under inversion symmetry irrelevant condition;
- Developed a surface group modification method for band gap engineering of Mxene;
- Demonstrated the Mxene electrode organic transistor and studied its contact properties;
- Developed a method to form high quality channel/dielectric interface in a 2D transistor;
- Developed a defect detection method for large scale CVD graphene;
- Developed a damage-free transfer method for CVD MoS<sub>2</sub>.

### 4. Research Techniques

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- Material synthesis: chemical vapor deposition, liquid exfoliation.
- Material characterization: microscopy (AFM, SEM etc.), spectroscopy (Raman, PL etc.).
- Device fabrication: e-beam lithography, photolithography, evaporator, plasma.
- Device measurement: transfer curve, contact resistance, Hall effect, dielectric constant etc.

### 5. Award

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[1] “National distinguished self-financed overseas student scholarship” China Scholarship Council

### 6. Patents

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[1] S Lee, **S Lai**, J Jeon, SK Jang “Method of manufacturing a 2-dimensional Mxene thin layer, method of manufacturing an electric element, and electric element” KR 10-1807390

[2] S Lee, **S Lai**, SH Choi, J Jeon, Y-J Song “Transcription method of two dimensional nano thinlayer” KR 10-1923772

[3] S Lee, SH Choi, SK Jang, **S Lai**, Y Yang “Method of manufacturing a 2-dimensional Mxene thin layer” KR 10-1966582

## 7. Publications

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### First author:

- [1] S Lai, H Liu, Z Zhang, J Zhao, X Feng, NZ Wang, C Tang, Y Liu, KS Novoselov, SA Yang, and W Gao “Third-order nonlinear Hall effect induced by the Berry-connection polarizability tensor” *Nature Nanotechnology* 2021 16 869
- [2] S Lai, J Jeon, SK Jang, J Xu, YJ Choi, JH Park, E Hwang, S Lee “Surface group modification and carrier transport properties of layered transition metal carbides ( $\text{Ti}_2\text{CT}_x$ , T: -OH, -F and -O)” *Nanoscale* 2015 7 19390 ([Web of Science citation Highly Cited Paper](#))
- [3] S Lai, SK Jang, JH Cho, S Lee “Organic Field-Effect Transistors Integrated with  $\text{Ti}_2\text{CT}_x$  Electrodes” *Nanoscale* 2018 10 5191
- [4] S Lai, S Byeon, SK Jang, J Lee, BH Lee, JH Park, YH Kim, S Lee “ $\text{HfO}_2/\text{HfS}_2$  hybrid heterostructure fabricated via controllable chemical conversion of two-dimensional  $\text{HfS}_2$ ” *Nanoscale* 2018 10 18758
- [5] S Lai, SK Jang, YJ Song, S Lee “Probing graphene defects and estimating graphene quality with optical microscopy” *Applied Physics Letters* 2014 104 043101
- [6] S Lai, J Jeon, YJ Song, S Lee “Water-penetration-assisted mechanical transfer of large-scale molybdenum disulfide onto arbitrary substrates” *RSC Advances* 2016 6 S7497

### Third author:

- [7] C Tang, Z Zhang, S Lai, Q Tan, W Gao “Magnetic Proximity Effect in Graphene/ $\text{CrBr}_3$  van der Waals Heterostructures” *Advanced Materials* 2020 32 1908498
- [8] J Jia, SK Jang, S Lai, J Xu, YJ Choi, JH Park, S Lee “Plasma-treated thickness-controlled two-dimensional black phosphorus and its electronic transport properties” *ACS nano* 2015 9 8729
- [9] Y Yang, S Umrao, S Lai, S Lee “Large-Area Highly Conductive Transparent Two-Dimensional  $\text{Ti}_2\text{CT}_x$  Film” *The journal of physical chemistry letters* 2017 8 859
- [10] J Xu, J Jia, S Lai, J Ju, S Lee “Tunneling field effect transistor integrated with black phosphorus- $\text{MoS}_2$  junction and ion gel dielectric” *Applied Physics Letters* 2017 110 033103

### Others:

- [11] C Jiang, A Rasmita, H Ma, Q Tan, Z Zhang, Z Huang, S Lai, N Wang, S Liu, X Liu, T Yu, Q Xiong, W Gao “A room-temperature gate-tunable bipolar valley Hall effect in molybdenum disulfide/tungsten diselenide heterostructures” *Nature Electronics* 2022 5 23
- [12] C Cai, Y Ma, J Jeon, F Huang, F Jia, S Lai, Z Xu, C Wu, R Zhao, Y Hao, Y Chen, S Lee, M Wang “Epitaxial Growth of Large-Grain NiSe Films by Solid-State Reaction for High-Responsivity Photodetector Arrays” *Advanced Materials* 2017 29 1606180
- [13] C Wang, R-C Xiao, H Liu, Z Zhang, S Lai, C Zhu, H Cai, N Wang, S Chen, Y Deng, Z Liu, SA Yang, W Gao “Room temperature third-order nonlinear Hall effect in Weyl semimetal  $\text{TaIrTe}_4$ ” *National Science Review* nwac020
- [14] H Liu, J Zhao, Y-X Huang, X Feng, C Xiao, W Wu, S Lai, W Gao, and SA Yang “Berry connection polarizability tensor and third-order Hall effect” *Physical Review B* 2022 105, 045118

## 8. Conferences

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<b>Oral</b>	Apr. 2014	2014 MRS Spring meeting	San Francisco, USA
<b>Oral</b>	Oct. 2016	230 <sup>th</sup> ECS Meeting	Honolulu, USA
<b>Poster</b>	Apr. 2016	2016 MRS Spring meeting	Phoenix, USA