RGC Ref.: NSFC Ref.: N_CUHK405/12
(please insert ref. above)

The Research Grants Council of Hong Kong
NSFC/RGC Joint Research Scheme
Joint Completion Report

(Please attach a copy of the completion report submitted to the NSFC by the Mainland researcher)

Part A: The Project and Investigator(s)

1. Project Title

Interfacial Engineering of Graphene Heterostructures and Its Device Applications

2. Investigator(s) and Academic Department/Units Involved

	Hong Kong Team	Mainland Team
Name of Principal Investigator *(with title)*	Prof. XU Jian Bin	Prof. WANG Xinran
Post	Professor and Director, Recipient of Chang Jiang Chair Professor	Professor and Recipient of Youth Thousand Talents Scheme
Unit / Department / Institution	Electronic Engineering Dept. & Materials Science and Technology Research Center, The Chinese University of Hong Kong	School of Electronic Science and Engineering, Nanjing University
Contact Information	Tel: (852) 3943 8297 Email: jbxu@ee.cuhk.edu.hk	Tel: (86) 25-83621502 Email: xrwang@nju.edu.cn
Co-investigator(s) *(with title and institution)*	Asso. Prof. MIAO Qian, Chemistry Dept. and Materials Science and Technology Research Center, Chinese University of Hong Kong	Prof. WANG Junzhuan, School of Electronic Science and Engineering/Nanjing University

3. Project Duration

	Original	Revised	Date of RGC/ Institution Approval *(must be quoted*)
Project Start date	Jan. 1, 2013		
Project Completion date	Dec. 31, 2016		

Duration *(in month)*	48 months		
Deadline for Submission of Completion Report			

Part B: The Completion Report

5. Project Objectives

5.1 Objectives as per original application

1.

1. *To develop a novel growth technique to produce high quality graphene sheets applicable for heterostructures, as well as a viable transfer process for locating graphene sheets onto SiO_2/Si substrate modified by self-assembled monolayer (SAM), and boron nitride substrate.*
2. *To develop new strategies for fabrication of graphene heterostructures for high performance devices with a largely improved on/off ratio of current.*
3. *To investigate electronic and optoelectronic properties of graphene heterostructures modified by physisorbed or chemisorbed molecules as well as substrates.*
4. *To explore novel device architectures for high performance electronic and optoelectronic devices.*
5. *To have better understanding of the graphene growth, heterostructures, and device operation through theoretical calculations.*

5.2 Revised Objectives: N. A.

Date of approval from the RGC: _____

Reasons for the change: _____

_____

6. Research Outcome

Major findings and research outcome
(maximum 1 page; please make reference to Part C where necessary)

We have accomplished the following major research findings. The relevant details can also be found in Section 5.3.

1. Accomplishment of a unique graphene growth process and refinement of an existing transfer process. Several polycyclic aromatic hydrocarbon (PAH) precursors, namely, coronene, triphenylene, pentacene, rubrene etc., were used to prepare large-area graphene sheets. More details can be found in Refs. #J3, #J10, #J13, and #J26.
2. Finding scattering sources that hinder the carrier mobilities of graphene and MoS_2 on bare SiO_2/Si substrate and OTMS SAM modified SiO_2/Si substrate. More details can be found in Refs. #J3, #J10, #J13, and #J31. The analytical methods can be used for other 2D materials.
3. Attainment of a high carrier mobility in CVD synthesized graphene up to 1.00×10^4 cm^2/V-s, along with a long mean free path, nearly vanished hysteretic behavior, and remarkably low intrinsic doping level. More details can be found in Refs. #J29, and #J31.
4. Advances in CVD synthesized WS_2-WSe_2 lateral heterstructures and electrochemical deposition of MoS_2. More details can be found in Refs. #J1, #J2, #J10, #J13, and #J15,
5. Advances in several new types of optoelectronic devices based graphene and other 2D semiconductor heterostructures. More details can be found in Refs. #J4, #J5, #J9, #J12, #J13, #J14, #J16, #J17, #J22, and #J30.
6. Development of new strategies for the weak epitaxial growth of organic semiconductors. More details can be found in Refs. #J7, #J8, #J11, and #J25.
7. Improved understanding of high-k gate dielectrics on carrier mobility of MoS_2 and graphene TFT. More details can be found in Refs. #J3, #J10, and #J13.
8. Development of new strategies for graphene lateral heterstructures. More details can be found in Refs. #J20, #J24, #J27, and #J28.
9. Theoretical investigations of the configuration-dependent properties of graphene monolayers and graphene nanoribbons, several carbon clusters on BN substrate, doping by metallic species on MoS_2 few layers, lateral phosphorene-graphene and phosphorene-WSe_2 heterostructures through DFT calculations. The relevant details can be found in Refs. J#6, J#18, J#19, J#21, and J#23.

Potential for further development of the research and the proposed course of action *(maximum half a page)*

1. SAM passivated SiO_2 and/or passivated Al_2O_3 on silicon substrate for graphene and other 2-dimensional layered semiconductors will be very useful for exploration of electronic and optoelectronic properties and novel device configurations.
2. Hybrid device architectures composed of graphene and 2D layered semiconductors as well as photoactive substrates can be further interrogated for high-performance optoelectronic devices with ultrahigh sensitivity and ultra-broad spectral range.
3. 2D organic layered semiconductors are a new class of 2D layered materials worth further exploration.

7. The Layman's Summary

(describe <u>in layman's language</u> the nature, significance and value of the research project, in no more than 200 words)

Single atomically-thick graphene and two-dimensional layered transition-metal dichalcogenides (TMDCs, or simply denoted 2D layered materials) are of considerable scientific and technological significance, thanks to their novel properties and the potential in flexible electronics/optoelectronics, as well as nanoelectronics/nanophotonics. A fundamental understanding of electronic, compositional, structural, and optical properties of the

atomically-thin films is vital in many possible applications, including light emitting devices (LEDs), field effect transistors (FETs), RFID transceivers, biosensors and hybrid solar cells. This project has focused on the interface engineering of graphene heterostructures that are the key elements for large area, flexible, light-weight, and low-cost electronics. After the intensive studies in understanding the interface properties of FETs and optoelectronic devices based on 2D layered materials, we have successfully attained: 1. preparation of high quality CVD graphene in centimeter scale and MoS_2 in millimeter scale, respectively; 2. one of the best transistors among graphene field-effect transistors on SAM modified SiO_2/Si substrates at room temperature; 3. highly sensitive photodetectors from visible to the near-infrared and mid-infrared spectral range; 4. a new processing strategy for organic layered semiconductors in the near future development; 5. novel architecture design for optoelectronic devices; 6. a new strategy for improving the device stability based on 2D layered materials. The project has unequivocally manifested the success of the interdisciplinary research.

Part C: Research Output

8. Peer-reviewed journal publication(s) arising directly from this research project

(Please attach a copy of each publication and/or the letter of acceptance if not yet submitted in the previous progress report(s). All listed publications must acknowledge RGC's funding support by quoting the specific grant reference.)

The Latest Status of Publications				Author(s) ***(bold** the authors belonging to the project teams and denote the corresponding author with an asterisk*)*	Title and Journal/ Book *(with the volume, pages and other necessary publishing details specified)*	Submitted to RGC *(indicate the year ending of the relevant progress report)*	Attached to this report *(Yes or No)*	Acknowledged the support of this Joint Research Scheme *(Yes or No)*	Accessible from the institutional repository *(Yes or No)*
Year of publication	Year of Acceptance *(For paper accepted but not yet published)*	Under Review	Under Preparation *(optional)*						
#J1, 2017				K. Chen, X. Wan**, J. B. Xu***	Epitaxial Stitching and Stacking Growth of Atomically Thin Transition-Metal Dichalcogenides (TMDCs) Heterojunctions, *Advanced Functional Materials* **27**, 1603884 (2017)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J2, 2017				X. Wan, K. Chen**, J. B. Xu***, et al.	Controlled Electrochemical Deposition of Large-Area MoS2 on Graphene for High-Responsivity Photodetectors, *Advanced Functional Materials* **2**7, 1603998 (2017)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J3, 2017				Z. H. Yu**, J. B. Xu, X. R. Wang***, et al.	Analyzing the Carrier Mobility in Transition-Metal Dichalcogenide MoS_2 Field-Effect Transistors, *Advanced Functional Materials* **2**7, 1604093 (2017)	No	Yes	No	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
J#4, 2017				X. D. Liu, Z. F. Chen, Ed. Parrott, Ben. S.-Y. Ung**, J. B. Xu,*** E. Pickwell-MacPherson*	Graphene Based Terahertz Light Modulator in Total Internal Reflection Geometry, *Adv. Optical Materials* **5**, 1600697 (2017)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J5, 2017				Z. F. Chen, X. M. Li*, J. Q. Wang, L. Tao, M. Z. Long, S. J. Liang, L. K. Ang, Chester Shu, H. K. Tsang, **J.-B. Xu***	Synergistic Effects of Plasmonics and Electron Trapping in Graphene Short-Wave Infrared Photodetectors with Ultrahigh Responsivity, *ACS Nano* **11**, 430 (2017)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J6, 2016				X. Q. Tian, L. Liu, Z. R. Gong, Y. Du, J. Gu, B. I. Yakobson*, **J. B. Xu**	Unusual electronic and magnetic properties of lateral phosphorene-WSe_2 heterostructures, *J. of Materials Chemistry* **4**, 6657 (2016)	No	Yes	No	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J7, 2016				X. L. Liu, X. G. Luo, **J. B. Xu, X. R. Wang***, et al.	Epitaxial Ultrathin Organic Crystals on Graphene for High-Efficiency Phototransistors, *Advanced Materials* **28**, 5200 (2016)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J8, 2016				B. Wu, Y. H. Zhao, H. Y. Nan, **J. B. Xu, X. R. Wang**, et al.	Precise, Self-Limited Epitaxy of Ultrathin Organic Semiconductors and Heterojunctions Tailored by van der Waals Interactions, *Nano Lett*. **16**, 3754 (2016)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J9, 2016				L. Ye, H. Li, Z. F. Chen, **J. B. Xu***	Near-Infrared Photodetector Based on MoS2/Black Phosphorus Heterojunction, *ACS Photonics* **3**, 692 (2016)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J10, 2016				X. Wan, K. Chen, W. G. Xie, & **J. B. Xu***	Quantitative Analysis of Scattering Mechanisms in Highly Crystalline CVD MoS2 through a Self-Limited Growth Strategy by Interface Engineering, *Small* **12**, 438 (2016)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J11, 2016				Y. H. Zhang, Q. S. Qiao**, J. B. Xu*, X. R. Wang***, et al.	Probing Carrier Transport and Structure-Property Relationship of Highly Ordered Organic Semiconductors at the Two-Dimensional Limit, *Phys. Rev. Lett.* **116**, 016602 (2016)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J12, 2016				J. Q. Wang, Z. Z. Cheng*, Z. F. Chen, **J. B. Xu**, et al.	High-responsivity graphene-on-silicon slot waveguide photodetectors, *Nanoscale* **8**, 13206 (2016)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J13, 2016				K. Chen, X. Wan, W. G. Xie, **J. B. Xu***, et al.	Lateral Built-In Potential of Monolayer MoS2-WS 2 In-Plane Heterostructures by a Shortcut Growth Strategy, *Advanced Materials* **27**, 6431 (2015)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J14, 2015				L. H. Liu, K. Xu, X. Wan, **J. B. Xu**, et al.	Enhanced optical Kerr nonlinearity of MoS_2 on silicon waveguides, *Photonics Research* **3**, 206 (2015)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J15, 2015				K. Chen, X. Wan, **J. B. Xu***, et al.	Electronic Properties of MoS_2-WS_2 Heterostructures Synthesized with Two-Step Lateral Epitaxial Strategy, *ACS Nano* **9**, 9868 (2015)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J16, 2015				Z. F. Chen, Z. Z. Cheng, J. Q. Wang, **J. B. Xu***, et al.	High Responsivity, Broadband, and Fast Graphene/ Silicon Photodetector in Photoconductor Mode, *Advanced Optical Materials* **3**, 1207 (2015)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J17, 2015				J. Q. Wang, Z. Z. Cheng, Z. F. Chen, **J. B. Xu**, et al.	Graphene photodetector integrated on silicon nitride waveguide, *J. Appl. Phys.* **117**, 144504 (2015)	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J18, 2015				X. Q. Tian, L. Liu, Y. Du*, J. Gu, **J. B. Xu**, B. I. Yakobson	Effects of 3d transition-metal doping on electronic and magnetic properties of MoS_2 nanoribbons, *Physical Chemistry Chemical Physics* **17** 1831 (2015)	No	Yes	No	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J19, 2015				X. Q. Tian*, L. Liu, L Y. Du, J. Gu, **J. B. Xu**, B. I. Yakobson	Variable electronic properties of lateral phosphorene-graphene heterostructures, *Physical Chemistry Chemical Physics* 17, 31685 (2015)	Feb. 2015	Yes	No	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J20, 2014				X. M. Wang, W. G. Xie, J. Chen, **J. B. Xu***	Homo- and Hetero-p-n Junctions Formed on Graphene Steps, *ACS Applied Materials & Interfaces* **6** (1), 3-8 (2014)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J21, 2014				X. Q. Tian, J. Gu, **J. B. Xu***, et al.	Configuration-dependent electronic and magnetic properties of graphene monolayers and nanoribbons functionalized with aryl groups, *Journal of Chemical Physics* **140**, 044712 (2014)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J22, 2014				L. Shao, X. X. M. Wang, H. T. Xu, J. F. Wang, **J. B. Xu***, L. M. Peng, H. Q. Lin	Nanoantenna-Sandwiched Graphene with Giant Spectral Tuning in the Visible-to-Near-Infrared Region, *Advanced Optical Materials* **2** (2), 162-170 (2014)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J23, 2014				X. Q. Tian*, Y. D. Wei, S. A. Edwards, Y. J. Yu, X. M. Cai, **J. B. Xu**	Self-assembly of carbon nanoclusters on dielectric boron nitride, *Applied Surface Science* **292**, 237 (2014)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J24, 2014				X. M. Wang, W. G. Xie**, J. B. Xu***	Graphene Based Non-Volatile Memory Devices, *Advanced Materials* **26** (31), 5496-5503 (2014)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J25, 2014				D. W. He, Y. A. Zhang, Q. F. Q. Song, H. X. Xu, K. Watanabe, T. Taniguchi, **J. B. Xu**, **X. R. Wang*,** et al.	Two-dimensional quasi-freestanding molecular crystals for high-performance organic field-effect transistors, *Nature Communications* **5**, Art. No. 5162 (2014), DOI:10.1038/ncomms6162	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J26, 2014				X. Wan, K. Chen**, J. B. Xu***	Interface Engineering for CVD Graphene: Current Status and Progress, *Small* **10** (22), 4443 (2014)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J27, 2013				X. M. Wang, H. T. Xu, J. Min, L. M. Peng, **J. B. Xu***	Carrier sheet density constrained anomalous current saturation of graphene field effect transistors: kinks and negative differential resistances, *Nanoscale* **5**, 2811 (2013)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J28, 2013				K. Chen, K X. Wan**, J. B. Xu***	Controllable modulation of the electronic properties of graphene and silicene by interface engineering and pressure, *Journal of Materials Chemistry C* **1** (32), 4869-4878 DOI:10.1039/c3tc30567h (2013)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#J29, 2013				X. Wan, K. Chen, J. Du, D. Q. Liu, J. Chen, X. Lai, W. G. Xie, **J. B. Xu***	Enhanced Performance and Fermi-Level Estimation of Coronene-Derived Graphene Transistors on Self-Assembled Monolayer Modified Substrates in Large Areas, *Journal of Physical Chemistry C* **117**, 4800 (2013)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J30, 2013				X. M. Wang, Z. Z. Cheng, K. Xu, H. K. Tsang*, **J. B. Xu***	High-responsivity graphene/silicon-heterostructure waveguide photodetectors, *Nature Photonics* **7** (11), 888-891 (2013)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#J31, 2013				K. Chen, X. Wan, X D. Q. Liu, Z. W. Kang, W. G. Xie, J. Chen, **Q. Miao**, **J. B. Xu***	Quantitative determination of scattering mechanism in large-area graphene on conventional and SAM-functionalized substrates at room temperature, *Nanoscale* 5, 5784 (2013)	Feb. 2015	Yes	No	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

9. Recognized international conference(s) in which paper(s) related to this research project was/were delivered *(Please attach a copy of each delivered paper. All listed papers must acknowledge RGC's funding support by quoting the specific grant reference.)*

Month/Year/ Place	Title	Conference Name	Submitted to RGC *(indicate the year ending of the relevant progress report)*	Attached to this report *(Yes or No)*	Acknowledged the support of this Joint Research Scheme *(Yes or No)*	Accessible from the institutional repository *(Yes or No)*
#C1, June 11 - June 14, 2013, Bremen, Germany	Interface engineering for graphene synthesis and devices	Novel 2D materials: tuning electronic properties on the atomic scale,	Feb. 2015	Yes, http://www.cecam.org/workshop-4-922.html	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C2, 2013年7 月31日-8 月1日，长春	Study of Interface Engineering for Graphene Synthesis and Devices	第8届全国暨华人有机分子和聚合物发光与光电特性学术会	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C3, Sept. 5-7, 2013, Beijing, China	Investigation of Interface Properties for Graphene Synthesis and Devices	ChinaNano2013	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C4, 2013年8月8日-15日，内蒙古·呼伦贝尔市（原海拉尔市）	单层石墨烯制备暨石墨器件的界面工程	第十届海峡两岸纳米科学与技术研讨会 (CSWNST10)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C5, 2013年12月20~22日，中国香港	单层石墨烯制备暨石墨器件的界面工程	2013年纳米 -表面和Graphene科学与技术全国会议	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C6, Dec. 15-18, 2013, Hong Kong, China	Graphene Synthesis and Device Applications via Interface Engineering	International Conference on Interdisciplinary Nanoscience for Energy, Life and Environment (INELE 2013)	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C7, April 21-25, 2014, San Francisco, USA	Abnormal Absorption in Graphene/Silicon-Heterostructure Waveguide	MRS Spring Meeting 2014	Feb. 2015	Yes	No	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#C8, ETH, June 2-3, 2014, Zurich, Switzerland	On Graphene Synthesis and Devices via Interface Engineering	International Symposium on Synthetic 2-dimensional Polymers	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C9, July 14-17, 2014, Montreal, Canada	Interface Engineering and Hybrid Structures for Graphene Transistors and Photodetectors	IEEE Photonic Society Topical Meeting	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C10, November 7-9, 2014, Guangzhou	石墨烯光电探测及晶体管的界面工程	Chinese Vacuum Society Annual Meeting	Feb. 2015	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C11, June 28 – July 3, 2015, Singapore	Nanoscopic Investigation on Graphene and its Related Devices	International Conference on Advanced Materials Technologies	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C12, Sept.3-5, 2015, Beijing	Study of Graphene-like Materials and Related Devices	China International Conference on Nanoscience and Nanotechnology	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C13, Sept 10-12, 2015, Changchun	Investigation on Graphene and MoS_2 and their Related Devices	Annual Meeting of Chinese Physical Society	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C14, Oct. 28-30, 2015, Qingdao	Investigation of Graphene and Graphene-Like Materials	2015 International Graphene Innovation Conference, plenary presentation	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C15, Jan. 7-9, 2016 Hong Kong	Exploration of Electronic Materials and Interface Engineering in the Flatland	2nd International Conference on Two-Dimensional Layered Materials	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C16, June 30-July 2, 2016, Shanghai	Adventure of Electronic Nanomaterials in the Flatland	International Symposium on Devices and Applications of Two-Dimensional Materials	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

#C17, July 31-August 5, 2016, Beijing	Understanding of Scattering Mechanisms in Highly Crystalline CVD Graphene and MoS_2 through Interface Engineering	International Conference on Semiconductor Physics	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK
#C18, Oct. 28-30, 2015, Qingdao	Progress of Electronic Nanomaterials in the Flatland	2016 International Graphene Innovation Conference, plenary presentation	No	Yes	Yes	Yes http://aims.cuhk.edu.hk/converis/portal?lang=zh_HK

10. Student(s) trained *(Please attach a copy of the title page of the thesis.)*

Name	Degree registered for	Date of registration	Date of thesis submission/ graduation
Xi WAN	PhD	August, 2009	September, 2013
Kun CHEN	PhD	August, 2009	May, 2013
Zefeng CHEN	PhD	August, 2013	May, 2017
Hao LI	PhD	August, 2013	August, 2017

11. Other impact *(e.g. award of patents or prizes, collaboration with other research institutions, technology transfer, etc.)*

1. Interface Engineering for Graphene Transistors and Photodetectors (石墨烯晶体管及其光电探测器的界面工程研究); Class II of the 2014 Natural Science Awards, Ministry of Education, China (2014年度高等學校科學研究優秀成果獎（科學技術）二等奖；中華人民共和國教育部)
Jian-Bin XU, Xiaomu Wang, Xi Wang, Kun Chen, Hon Ki Tsang, Zhenzhou Cheng, Wei-Guang Xie, Xiao-qing Tian (許建斌，王肖沐，萬茜，陳琨，曾漢奇，程振洲，謝偉廣，田曉慶), see more at http://www.cutech.edu.cn/cn/zxgz/2014/12/1417370527164216.htm

2. Jian-Bin Xu, named as Chang Jiang Scholar Chair Professor by Ministry of Education, China; tenable to School of Electronic Science and Engineering, Nanjing University, Nov., 2014. See more at: http://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/s5972/201411/177981.html
The success is partially related to the current research project. The two teams will collaborate and exchange more, according to the required activities and duties under the Scheme of Chang Jiang Scholars.

3. Jian-Bin Xu, named as Vice-Chancellor's Outstanding Fellow of Faculty of Engineering, The Chinese University of Hong Kong, Aug. 1, 2014- July 31, 2019.

4. Jian-Bin Xu, Recipient of Research Excellence Award, Faculty of Engineering, The Chinese University of Hong Kong, October, 2015

5. Jian-Bin Xu, named as Outstanding Researcher of The Chinese University of Hong Kong, by Nature Index 2014.