Curriculum Vitae

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Job Experience

Professor, Oct. 2020-present
Sungkyunkwan University (SKKU), Dept. of Mechanical Engineering & SKKU Advanced Institute of Nano technology (SAINT), Suwon, Korea

Associate Professor, Oct. 2014-present
Sungkyunkwan University (SKKU), Dept. of Mechanical Engineering & SKKU Advanced Institute of Nano technology (SAINT), Suwon, Korea

Assistant Professor, Sep. 2010-Sep. 2014
Sungkyunkwan University (SKKU), Dept. of Mechanical Engineering & SKKU Advanced Institute of Nano technology (SAINT), Suwon, Korea

Post-doctoral Researcher, Mar. 2006-Aug. 2010
Columbia University, New York, NY
Supervisor: James Hone

Education

Columbia University, New York, NY
Ph.D. *with distinction* in Mechanical Engineering, Sep. 2001-Feb. 2006
Thesis advisor: Luc G. Fréchette
Development of a microfabricated turbopump for a Rankine vapor power cycle

Hanyang University, Seoul, Korea
M.S. in Mechanical Engineering, Mar. 1995-Feb. 1997
Thesis advisor: Sanghwan Lee
Analytical study on Reynolds number dependence of velocity profile of a fully developed turbulent flow in circular pipe

Hanyang University, Seoul, Korea
B.S. in Mechanical Engineering, Mar. 1991-Feb. 1995

Award and Honors

- Best researcher award from Korean Society of Mechanical Engineers, 2020

- SKKU Young-Fellowship awarded from Sungkyunkwan University for best research performance, 2019
- Best teaching award from Engineering school of Sungkyunkwan University, 2012
- Ph.D degree with distinction awarded to top 10% graduates from Columbia University, 2006

Current Research Interest

- Synthesis and physical properties of 2D magnetic materials (Fe3GeTe2, CrPS4, CrI3, etc.)
- Spintronics and spintronic devices based on 2D magnets
- Novel half-metallic magnetic materials
- Optoelectronic device fabrication and characterization of 2D materials
- Physical property characterization of 2D materials under high strain using AFM-Raman tool
- CVD Synthesis and characterization of single and poly-crystalline Graphene, MoS2, MoSe2, WSe2, ReS2, ReSe2, and NbS2
- Thin film transistors of metal chalcogenides
- Direct synthesis of MoS2 on plastic substrates using PECVD
- Synthesis of MoS2 and metal chalcogenides on plastic substrates using printing and laser techniques
- Development of synthesis of metal chalcogenides on metal substrates and transfer to other substrates
- Electrical and optical properties of MoS2 and 2D materials
- Physical properties of 2D materials under ultra-high strain using AFM techniques
- Liquid exfoliation of various 2D materials
- Mechanics and molecular separation using graphene oxide
- Mechanical properties 2-dimensional (2D) materials (graphene, h-BN, MoS2, Phosphorene)
- Tribological characteristics of atomically-thin graphene, MoS2, and h-BN films and their composites
- Composites of 2D nanomaterials and their mechanical and electrical applications
- AFM & Raman characterization of 2D nanomaterial's properties
- Structural studies of Phosphorene with TEM, AFM, and spectroscopies
- Oxidation and anti-oxidation studies of Phosphorene

Research Experience

Columbia University *(2006-2010)*

- Mechanical properties of monolayer, multilayer, and hydrogenated graphene

- Frictional characteristics of atomically-thin graphene, MoS2, h-BN, and NbSe2 films
- AFM nanoindentation and friction force microscopy
- Flow sensing and fluidic power conversion in graphene and carbon nanotubes
- Optical and electronic properties of mono- and few-layer MoS2: Raman, absorbance, and photoluminescence spectroscopy
- Graphene synthesis: CVD and chemical exfoliation
- Electrical properties of h-BN films
- Nanofabrication of structures for cell-mechanics experiments using electron beam and nanoimprint lithography techniques

Columbia University *(2001- 2006)*

- Cycle analysis and design of a micro power plant-on-a-chip: Implementation of Rankine steam cycle at a micro scale
- Microfabrication of the five-wafer micro-turbopump device using silicon bulk micromachining techniques
- Complete characterization of each component of the device: turbine, pump, thrust bearing, journal bearing, and seal
- CFD calculations for the design of the device
- Derivation of an analytical solution of the flow along parallel microchannels separated by an anisotropic porous membrane

Hanyang University (*1995-1997)*

- CFD of turbulence modeling
- Derivation of an analytical solution of near-wall turbulent flow in pipe

Publications

Journal papers:

*** corresponding author**

1. Jierui Liang, Shanchuan Liang, Ti Xie, Andrew F. May, Thomas Ersevim, Qinqin Wang, Hyobin Ahn, **Changgu Lee**, Xixiang Zhang, Jian-Ping Wang, Michael A. McGuire, Min Ouyang, Cheng Gong, "Facile integration of giant exchange bias in Fe5GeTe2/oxide heterostructures by atomic layer deposition" ***Physical Review Materials***, 7(1) 014008, 2023
2. Suhyeon Kim, Sangho Yoon, Hyobin Ahn, Gangtae Jin, Hyesun Kim, Moon-Ho Jo, **Changgu Lee**, Jonghwan Kim, Sunmin Ryu, "Photoluminescence Path Bifurcations by Spin Flip in Two-Dimensional CrPS4" ***ACS nano***, 16(10), 16385-16393, 2022
3. Yisehak Gebredingle, Minwoong Joe, **Changgu Lee***, "First-Principles Calculations of the Spin-Dependent Electronic Structure and Strain Tunability in 2D Non-van der Waals Chromium Chalcogenides Cr2X3 (X = S, Se, Te):

Implications for Spintronics Applications" ***ACS applied nano materials***, 5(8) 10383-10391, 2022

4. Ziba torkashvand, Kavoos Mirabbaszadeh, Farzaneh Shayeganfar, **Changgu Lee**, "Magneto-optical Kerr effectin surface engineered 2D hexagonalboron nitride" ***Scienctific reports***, 12:10919, 2022
5. Kyuyeon won, Chanwoo Lee, Jaehyuck Jubg Sanghyuk Kwon, Yisehak Gebredingle, Jang Gyun Lim, Moon Ki Kim, Mun Seok Jeong, **Changgu Lee***, "Raman Scattering Measurement of Suspended Graphene under Extreme Strain Induced by Nanoindentation" **Advanced materials**, 34(30), 2200946, 2022
6. Yisehak Gebredingle, Minwoong Joe, **Changgu Lee***, "Cr2S3 a bipolar semiconducting fully compensated ferrimagnet" ***Physical Review Materials***, 6(5), 054405, 2022
7. Sung Jong Kim Dongwon Choi, Kyoung-Whan Kim, Ki-Young Lee, Duck-Ho Kim, Seokmin Hong, Joonki Suh, **Changgu Lee**, Se Kwon Kim Tae-Eon Park, Hyun Cheol Koo, "Interface Engineering of Magnetic Anisotropy in van der Waals Ferromagnet-based Heterostructures" ***ACS nano***, 15(10), 16395-16403, 2021
8. Xiao-Xiao Zhang, Shengwei Jiang, Jinhwan Lee, **Changgu Lee**, Kin Fai Mak, Jie Shan, "Spin Dynamics Slowdown near the Antiferromagnetic Critical Pointin Atomically Thin FePS3" ***Nano letters***, 21(12), 5045-5052, 2021
9. Mingwoong Joe, Pawan Kumar Srivastave, Budhi Singh, Hyobin Ahn, **Changgu Lee***, "Iron-based ferromagnetic van der Waals materials" ***Journal of Physics D: Applied Physics***, 54(47), 473002, 2021
10. Youngchan Kim, Euihoon Jeong, Minwoong Joe, **Changgu Lee***, "Synthesis of 2D semiconducting single crystalline Bi2S3 for high performance electronics" " ***Physical Chemistry Chemical Physics***, 23(47), 26806-26812, 2021
11. Muhammad Sabbtain Abbas, Pawan Kumar Srivastave, Yasir Hassan, **Changgu Lee*,** "Asymmetric carrier transport and weak localization in few layer graphene grown directly on a dielectric substrate" ***Physical Chemistry Chemical Physics***, 23(44), 25284-25290, 2021
12. Soomook Lim, Hyunsoo Park, Go Yamamoto, **Changgu Lee**, Ji Won Suk, "Measurement of the electrical conductivity of monolayer graphene flakes using conductive atomic force microscopy" ***Nanomaterials***, 11(10), 2575, 2021
13. Trinh Thi Ly, Jungmin Park, Hyo=Bin Ahn, Nyun Jong Lee, Kwangsu Kim Tae-Eon Park, Ganbat Duvjir, Nguyen Huu Lam, Kyuha Jang, Chun-Yeol You, Younghun Jo, Se Kwon Kim, **Changgu Lee***, Snaghoon Kim*, Jungdae Kim* "Direct Observation of Fe-Ge Ordering in Fe5−xGeTe2 Crystals and Resultant Helimagnetism", ***Advanced Functional Materials***, 31(17), 2009758, 2021

14. "Resonant tunnelling diodes based on twisted black phosphorus homostructures", Pawan Kumar Srivastava, Yasir Hassan, Duarte J.P. de Sousa, Yisehak Gebredingle, Minwoong Joe, Fida Ali, Yang Zheng, Won Jong Yoo, Subhasis Ghosh, James T. Teherani, Budhi Singh, Tony Low and **Changgu Lee***, ***Nature electronics***, 4, 269-276, 2021.

15. Sujin Kim, Jinhwan Lee, **Changgu Lee**, Sunmin Ryu, "Polarized Raman Spectra and Complex Raman Tensors of Antiferromagnetic Semiconductor CrPS4", ***The Journal of Physical Chemistry C***, 125, 2691-2698, 2021

16. Yasir Hassan, Pawan Kumar Srivastava, Budhi Singh, Muhammad Sabbtain Abbas, Fida Ali, Won Jong Yoo, and **Changgu Lee***, "Phase-Engineered Molybdenum Telluride/Black Phosphorus Van der Waals Heterojunctions for Tunable Multivalued Logic", ***ACS Applied Materials & Interfaces***, vol 2020, 14119-14124, 2020.

17. Xiangru Kong, Giang D. Nguyen, Jinhwan Lee, **Changgu Lee**, Stuart Calder, Andrew F. May, Zheng Gai, An-Ping Li, Liangbo Liang, Tom berlijn, "Interlayer magnetism in Fe3−xGeTe2", ***Physical Review Materials***, 4, 094403, 2020

18. Yunjeong Park, Byunggil Kang, CheolHyoun Ahn, HyungKoun Cho, Hyukjoon Kwon, Sungsu Park, Junhwan Kwon, Myunghwan Choi, **Changgu Lee***, Kyunghoon Kim*, "Bionanoelectronic platform with a lipid bilayer/CVD-grown MoS2 hybrid", ***Biosensors & Bioelectronics***, vol 142, 111512, 2019.

19. Fida Ali, Faisal Ahmed, Zheng Yang, Inyong Moon, Myeongjin Lee, Yasir Hassan, **Changgu Lee***, Won Jong Yoo*, "Energy Dissipation in Black Phosphorus Heterostructured Devices", ***Advanced Materials Interfaces***, 6, 1801528, 2019.

20. Yongsuk Choi, Hunyoung Bark, Boseok Kang, Myeongjae Lee, BongSoo Kim, Sungjoo Lee, **Changgu Lee**, Jeong Ho Cho, "Wafer-scale and patternable synthesis of NbS2 for electrodes of oragenic transistors and logic gates", ***Journal of Materials Chemistry C***, 7, 8599, 2019

21. Sultan Albarakati, Cheng Tan, Zhong-Jia Chen, James G, Partridge, Guolin Zheng, Lawrence Farrar, Edwin L. H. Mayes, Matthew R. Field, **Changgu Lee**, Yihao Wang, Yiming Xiong, Mingliang Tian, Feixiang Xiang, Alex R. Hamilton, Oleg A. Tretiakov, Dimitrie Culcer, Yu-Jun Zhao, Lang Wang, "Antisymmetric magnetoresistance in van der Waals Fe3GeTe2/graphite/Fe3GeTe2 trilayer heterostructures", ***Science Advances***, 5, eaaw0409, 2019

22. Ajjiporn DAthbum, Youngchan Kim, Yongsuk Choi, Jai Sun, Seongchan Kim, Byunggil Kang, Moon Sung Kang, Do Kyung Hwang, Sungjoo Lee, **Changgu**

Lee, Jeong Ho Cho, "Selectively Metallized 2D Materials for Simple Logic Devices", ***ACS Applied Materials and Interfaces***, 11, 18571, 2019

23. Suhyeon Kim, Jinhwan Lee, Gangtae Jin, Moon-Ho Jo, **Changgu Lee**, Sunmin Ryu, "Crossover between Photochemical and Photothermal Oxidations of Atomically Thin Magnetic Semiconductor CrPS4", ***Nano Leetters***, 19, 4043, 2019

24. Dongseuk Kim, Sijin Park, Jinhwan Lee, Jungbum Yoon, Sungjung Joo, Taeyueb Kim, Kil-joon Min, Seung-Young Park, Changsoo Kim, Kyoung-Woong Moon, **Changgu Lee**, Jisang Hong, Chanyong Hwang, "Antiferromagnetic coupling of van der Waals ferromagnetic Fe3GeTe2", ***Nanotechnology***, 30, 245701, 2019

25. Youngchan Kim, Hunyoung Bark, Byunggil Kang, **Changgu Lee***, "Wafer-Scale Substitutional Doping of Monbolayer MoS2 Films for High-Performance Optoelectronics Devices", ***ACS Appliec Materials and Interfaces***, 11, 12612, 2019

26. Pawan Kum Srivastava, Yasir Hassan, Yisehak Gebredingle, Jaehyuck Jung, Byunggil Kang, Won Jong Yoo, Budhi Singh, **Changgu Lee***, "Van der Waals Brok-Gap p-n Heterojuction Tunnel Diode Based on Black Phosphorus and Rhenium Disulfide", ***ACS Applied Materials and Interfaces***, 11, 8266, 2019

27. Pawan Kum Srivastava, Yasir Hassan, Yisehak Gebredingle, Jaehyuck Jung, Byunggil Kang, Won Jong Yoo, Budhi Singh, **Changgu Lee***, "Multifunctional van der Waals Broken-Gap Heterojunction", ***Small***, 15, 1804885, 2019

28. Jaehyuck Jung, Jinhwan Lee, Youngchan Kim, Hunyoung Bark, Changgu Lee*, "Ultrafast and low-temperature synthesis of patternable MoS2 using laser irradiation", ***Journal of Physics D: Applied Physics***, 52, 18LT01, 2019

29. Minwoo Ahn, Renlong Liu, **Changgu Lee***, Wonyoung Lee* "Designing Carbon/Oxygen Rations of Grapheen Oxide Membranes for Proton Exchange Membrane Fuel Cells", ***Journal of nanomaterials***, 6464713, 2019

30. Jaehyuck Jung, Hunyoung Bark, Doyoung Byun, **Changgu Lee***, Dae-Hyun Cho* "Mechanical characterization of phase-changed single-layer MoS2 sheets", ***2D Materials***, 6, 025024, 2019

31. Minwoong Joe, Jinhwan Lee, **Changgu Lee*** "Dominant in-plane cleavage direction of CrPS4", ***Computation Materials Science***, 162, 277, 2019

32. Dae-Hyun Cho, Jaehyuck Jung, Chan Kim, Jinhwan Lee, Se-Doo Oh, Kwang-Seop Kim, Changgu Lee "Comparison of Frictional Properties of CVD-Grown MoS2 and Graphene Films under Dry Sliding Conditions", ***Nanomaterials***, 9, 293, 2019

33. Fida Ali, Faisal Ahmed, Zheng Yang, Inyong Moon, Myeongjin Lee, Yasir Hassan, **Changgu Lee**, Won Jong Yoo, "Energy Dissipation in Black

Phosphorus Heterostructured Devices", ***Advanced Materials Interfaces***, 6, 1801528, 2018

34. Su Kong Chong, Kyu Bum Han, Akira Nagaoka, Ryuichi Tsuchikawa, Renlong Liu, Haoliang Liu, Zeev Valy Vardeny, Dmytro A. Pesin, **Changgu Lee**, Taylor D. Sparks, Vikram V. Deshpande, "Topological Insulator-Based van der Waals Heterostructures for Effective Control of Massless and massive Dirac Fermions", ***Nano Letters***, 18, 8047, 2018
35. Byunggil Kang, Youngchan Kim, Won Jong Yoo, **Changgu Lee***, "Ultrahigh Photoresponsive Device Based on ReS2/Graphene Heterostructure", ***Small***, 14, 1802593, 2018
36. Cheng Tan, Jinhwan Lee, Soon-Gil Jung, Tuson Park, Sultan Albarakati, James Partridge, Matthew R. Field, Dpougal G. McCulloch, Lan Wang, **Changgu Lee*** "Hard magnetic properties in nano flake van der Waals Fe3GeTe2", ***Nature Communications***, 9, 1554, 2018
37. Giang D. Nguyen, Jinhwan Lee, Tom berlijn, Qiang Zou, Saban M. Hus, Jewook Park, Zheng Gai, **Changgu Lee**, An-Ping Li, "Visualization and manipulation of magnetic domains in the quasi-two-dimensional material Fe3GeTe2", ***Physical Review B***, 97, 014425, 2018
38. Hunyoung Bark, Yongsuk Choi, Jaehyuck Jung, Jung Hwa Kim, Hyukjoon Kwon, Jinhwan Lee, Zonghoon Lee, Jeong Ho Cho, **Changgu Lee***, "Large-area niobium disulfide thin films as transparent electrodes for devices based on two-dimensional materials", ***Nanoscale***, 10, 1056-1062, 2018
39. Seung Ryul Na, Youngchan Kim, **Changgu Lee***Kenneth M. Liechti*, Ji Won Suk*, "Adhesion and self-healing between monolayer molybdenum disulfide and silicon oxide", ***Scientific Reports***, 7:14740, 2017
40. Renlong Liu, Tao Gong, Kan Zhang, **Changgu Lee***, "Graphene oxide papers with high water adsorption capacity for air dehumidification", ***Scientific Reports***, 7:9761, 2017
41. Jinhwan Lee, Taeg Yeoung Ko, Jung Hwa Kim, Hunyoung Bark, Byunggil Kang, Soon-Gil Jung, Tuson Park, Zonghoon Lee, Sunmin Ryu*, **Changgu Lee***, "Structural and optical properties of single- and few-layer magnetic semiconductor CrPS4", ***ACS nano***, 11, 10935-10944, 2017
42. Minwoong Joe, Hosik Lee, M Menderes Alyoruk, Jinhwan Lee, Sung Youb Kim, **Changgu Lee***, Jun Hee Lee*, "A comprehensive study of piezomagnetic response in CrPS4 monolayer: mechanical, electronic properties and magnetic ordering under strains", ***Journal of Physics: Condensed Matter***, 29, 405801, 2017

43. Ajjiporn Dathbun, Youngchan Kim, Seongchan Kim, Youngjae Yoo, Moon Sung Kang, **Changgu Lee***, Jeong Ho Cho*, "Large-Area CVD-Grown Sub-2 V ReS2 Transistors and Logic Gates", ***Nano letters*, 17,** 2999-3005, 2017

44. Youngchan Kim, Byunggil Kang, Yongsuk Choi, Jeong Ho Cho, **Changgu Lee**, "Direct synthesis of large-area continuous ReS2 films on a flexible glass at low temperature", ***2D materials*, 4**, 025057, 2017

45. Byunggil Kang, Youngchan Kim, Jeong Ho Cho, **Changgu Lee***, "Ambipolar transport based on CVD-synthesized ReSe2", ***2D materials*, 4**, 025014, 2017

46. Inyeal Lee, Servin Rathi, Dongsuk Lim, Lijun Li, Jinwoo Park, Yoontae Lee, Kyung Soo Yi, Krishna P. Dhakal, Jeongyong Kim, **Changgu Lee**, Gwan-Hyoung Lee, Young Duck Kim, James Hone, Sun Jin Yun, Doo-Hyeb Youn, Gil-Ho Kim, "Gate-tunable hole and electron carrier transport in atomically thin dual-channel WSe2/MoS2 heterostructure for amibopolar field-effect transistors", ***Advanced Materials***, 28, 9519-9525, 2017

47. Hoang Danh Phan, Youngchan Kim, Jinhwan Lee, Renlong Liu, Yongsuk Choi, Jeong Ho Cho, **Changgu Lee***, "Ultraclean and direct transfer of a wafer-scale MoS2 thin film onto a plastic substrate", ***Advanced Materials*, 29**(17), 1603928, 2017

48. Hongyi Qin, Yinhua Jin, Tao Gong, Yujin Cho, Chisung Ahn, Cheolmin Shin, **Changgu Lee***, Taesung Kim*, "A Conductive Copolymer Based on Graphene Oxide and Poly (amidoxime-pyrrole) for Adsorption of Uranium (VI)", ***Nano*, 11**(4), 1650045, 2016

49. Xiaoding Wei, Zhaoxu Meng, Luis Ruiz, Wenjie Xia, **Changgu Lee**, Jeffrey W. Kysar, James C. Hone, Sinan Keten, Horacio D. Espinosa, "Recoverable Slippage Mechanism in Multilayer Graphene Leads to Repeatable Energy Dissipation", ***ACS nano*, 10**, 1820, 2016

50. Hunyoung Bark, Sanghyuk Kwon, **Changgu Lee***, "Bias-assisted atomic force microscope nanolithography on NbS2 thin films grown by chemical vapor deposition" ***Journal of Physics D: Applied Physics*, 49**, 484001, 2016

51. Hoang Danh Phan, Jaehyuck Jung, Youngchan Kim, Van Ngoc huynh, **Changgu Lee***, "Large-area single-crystal graphene grown on a recrystallized Cu(111) surface by using a hole-pocket method", ***Nanoscale***, **8**, 13781, 2016

52. Youngchan Kim, Hunyoung Bark, Gyeong Hee Ryu, Zonghoon Lee, **Changgu Lee***, "Wafer-scale monolayer MoS2 grown by chemical vapor deposition using a reaction of MoO3 and H2S", ***Journal of Physics: condensed matter***, **28**, 184002, 2016

53. Gyeong Hee Ryu, Jongyeong Lee, Na Yeon Kim Yeongdong Lee, Youngchan Kim, Moon J Kim, **Changgu Lee**, Zonghoon Lee, "Line-defect mediated

formation of hole and Mo clusters in monolayer molybdenum disulfide", ***2D Materials***, **3**, 014002, 2016

54. Youngbin Lee, Hyunmin Kim, Jinhwan Lee, Seong Hun Yu, Euyheon Hwang, **Changgu Lee**, Jong-Hyun Ahn, Jeong Ho Cho, "Enhanced Raman Scattering of Rhodamine 6G Films on Two-Dimensional Transitoin Metal Dichalcogenides Correlated to Photoinduced Charge Transfer", ***Chemistry of Materials***, **28**, 180-187, 2016

55. Soo Min Kim, Allen Hsu, Min Ho Park, Sang Hoon Chae, Seok Joon Yun, Joo Song Lee, Dae-Hyun Cho, Wenjing Fang, **Changgu Lee**, Tamos Palacios, Mildred Dresselhaus, Ki Kang Kim, Young Hee Lee, Jing Kong, "Synthesis of large-area multilayer hexagonal boron nitride for high material performance", ***Nature Communications***, **6**, 9662, 2015

56. Jungcheol Kim, Jae-Ung Lee, Jinhwan Lee, Hoy Ju Park, Zonghoon Lee, **Changgu Lee***, Hyeongsik Cheong*, "Anomalous polarization dependence of Raman scattering and crystallographic orientation of black phosphorus", ***Nanoscale***, **7**, 18708, 2015

57. Seul-Gi Kim, Dong-Wook Shin, Taesung Kim, Sooyoung Kim, Jung Hun Lee, **Changgu Lee**, Cheol-Woong Yang, Sungjoo Lee, Sang Jin Cho, Hwan Chul Jeon, Mun Ja kim, Byung-Gook Kim, Ji-Beom Yoo, "Large-scale freestanding nanometer-thick graphite pellicles for mass production of nanodevices beyond 10 nm", ***Nanoscale***, **7**, 14608, 2015

58. Jinseon Kim, Sanghyuk Kwon, Dae-Hyun Cho, Byunggil Kang, Hyukjoon Kwon, Youngchan Kim, Sung O. Park, Gwan Yeong Jung, Eunhye Shin, Wan-Gu Kim, Hyungdong Lee, Gyeong Hee Ryu, Minseok Choi, Tae Hyeong Kim, Junghoon Oh, Sungjin Park, Sang Kyu Kwak, Suk Wang Yoon, Doyoung Byun, Zonghoon Lee, and **Changgu Lee***, "Direct exfoliation and dispersion of two-dimensional materials in pure water via temperature control", ***Nature Communications***, DOI: 10: 1038/ncomms9292, 2015

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60. Doo-Won Lee, Jinhwan Lee, Il Yung Sohn, Bo-Yeong Kim, Young Min Son, Hunyoung Bark, Jaehyuck Jung, Minseok Choi, Tae Hyeong Kim, **Changgu Lee***, Nae-Eung Lee*, "Field-Effect Transistor with a Chemically Synthesized MoS2 Sensing Channel for label-free and Highly Sensitive electrical Detection of DNA hybridization", ***Nano Research***, **8**, 2340-2350, 2015

61. Chisung Ahn, Jinhwan Lee, Hyeong-U Kim, Hunyoung Bark, Minhwan Jeon, Gyeong Hee Ryu, Zonghoon Lee, Geun Young Yeom, Kwangsu Kim Jaehyuk Jung, Youngseok Kim, **Changgu Lee***, and Taesung Kim*, "Low-Temperature

Synthesis of Large-Scale Molybdenum Disulfide Thin Films Directly on a Plastic Substrate using Plasma-Enhanced Chemical Vapor Depositon" ***Advanced Materials***, **27**, 5223-5229, 2015

62. Hongyi Qin, Tao Gong, Yujin Cho, Cheolmin Shin, **Changgu Lee***, and Taesung Kim*, "A Simple and Economical Method using Grahene Oxide for the Fabrication of Water/Oil Separation Papers", ***RSC Advances***, **5**, 57860-57864, 2015

63. Hongyi Qin Tao Gong, Yinhua Jin, Yujin Cho, Cheolmin Shin, Changgu Lee*, Taesung Kim*, "Nearu-UV emitting Graphene Quantum Dots from Graphene Hydrogels", ***Carbon***, **94**, 181-188, 2015

64. Jong Hun Kim, Jinhwan Lee, Jae Hyeong Kim, C. C. Hwang, **Changgu Lee***, Jeong Young Park*, "Work Funciton variation of MoS2 atomic Layers Grown with Chemical Vapor Deposition: The Effects of Thickness and the Adsorption of Water/Oxygen Molecules", ***Applied Physics Letters***, **106**, 251606, 2015

65. Tao Gong, Do Van Lam, Renlong Liu, Sejeong Won, Yun Hwangbo, Sanghyuk Kwon, Jinseon Kim, Ke Sun, Jae-Hyun Kim, Seung-Mo Lee, and **Changgu Lee**, "Thickness Dependence of the Mechanical Properties of Free-Standing Graphene Oxide Papers", ***Advanced Functional Materials***, **25**, 3756-3763, 2015

66. Do Van Lam, Tao Gong, Sejeong Won, Jae-Hyun Kim, Hak-Joo Lee, **Changgu Lee**, and Seung-Mo Lee, "A robust and conductive metal-impregnated graphene oxide membrane selectively separating organic vapors", ***Chemical Communications***, **51**, 2671-2674, 2015

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68. Hyo Jin Kim, Sung-Min Lee, Yoon-Suk Oh, Young-Hwan Yang, Young Soo Lim, Dae Ho Yoon, **Changgu Lee**, Jong-Young Kim, Rodney S. Ruoff, "Unoxidized Graphene/Alumina Nanocomposite: Fracture- and Wear-Resistance Effects of Graphene on Alumina Matrix," ***Scientific Reports***, DOI: 10.1038/srep05176, 2014

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71. Youngbin Lee, Jinhwan Lee, Hunyoung Bark, Il-Kwon Oh, Gyeong Hee Ryu, Zonghoon Lee, Hyungjun Kim, Jeong Ho Cho, Jong-Hyun Ahn and **Changgu Lee***, "Synthesis of wafer-scale uniform molybdenum disulfide films with

control over the layer number using a gas phase sulfur precursor," ***Nanoscale***, **6**, 2821, 2014

72. Youngchan Kim, Dae-Hyun Cho, Sunmin ryu, **Changgu Lee***, "tuning doping and strain in graphene by microwave-induced annealing," ***Carbon***, **67**, 673, 2014

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