JOONKI SUH

Associate Professor
Department of Materials Science and Engineering, UNIST
Graduate School of Semiconductor Materials and Devices Engineering, UNIST
102 Engineering Building 1, Room 401-2, 50 Unist-gil, Ulju-gun, Ulsan 44919, Korea
@ jsuh@unist.ac.kr; joonki.suh@gmail.com +82.52.217.2461 http://joonkisuhlab.org [Link]

EDUCATION

University of California at Berkeley	Materials Science and Engineering (Minors in Physics and Electrical Engineering)	Ph.D.	2015
Stanford University	Materials Science and Engineering	M.S.	2009
Yonsei University	Materials Science and Engineering	B.S.	2006

APPOINTMENTS

Ulsan National Institute of Science and Engineering (UNIST)

- Associate Professor of Materials Science and Engineering & Semiconductor Materials and Devices Engineering — Sep. 2023 – Present
- Assistant Professor of Materials Science and Engineering — Jul. 2019 – Aug. 2023
- Assistant Professor of Semiconductor Materials and Devices Engineering — Sep. 2021 – Aug. 2023

University of Chicago & Cornell University

- Postdoctoral Associate, Department of Chemistry — 2016 – 2019

HONORS AND AWARDS

2022	K-CHIPS Award, Consortium of Semiconductor Advanced Research (Namwook Hur)
2018	Kharasch Travel Award, Department of Chemistry, University of Chicago
2018	Best Presentation Silver Awards, Materials Research Society Spring Meeting
2017	Outstanding Reviewer Awards, IOP Publishing
2014 – 2015	Jane Lewis Fellowship, College of Engineering, University of California at Berkeley
2014	Ovshinsky Student Travel Award, Division of Materials Physics, American Physical Society
2013	Nano-Graduate Student Research Award, MSE, University of California at Berkeley
2010 – 2012	Energy Experts Development Program (2-year Fellowship), Korea Institute of Energy Technology Evaluation and Planning
2010 – 2011	The Chancellor's Fellowship for Graduate Study, University of California at Berkeley
2005	University Designated Scholarship (Truth), Yonsei University
2005	Honors Student, Yonsei University
2005	Yonsei Alumni Association Scholarship, MSE, Yonsei University (1st recipient)

RESEARCH GRANTS

Serving as the principal investigator (PI)

- 삼성미래기술육성사업, Samsung Research Funding & Incubation for Future Technology, 2024 – Present
- 우수신진연구(글로벌협력), National Research Foundation of Korea, 2024 – Present
- 우수신진연구(최초혁신실험실지정), National Research Foundation of Korea, 2020 – 2024
- Air Force Office of Scientific Research (AFOSR) USA, 2023 – Present
- 미래반도체소자 원천기술개발사업, Korea Evaluation Institute of Industrial Technology & Korea Semiconductor Industry Association, 2020 – 2022
- 양자정보과학 연구개발생태계조성사업, National Research Foundation of Korea, 2020 – 2022
- 상용표준물질개발·보급사업, Korea Evaluation Institute of Industrial Technology, 2022 – 2023

- Industry funding: Tokyo Electron Ltd., 2024 – Present
  Samsung Electronics (UNIST-Samsung Cluster), 2023 – Present
  Mecaro, 2021 – 2022
- R&E project, Daegu Science High School, 2020
- 신임교수정착과제, Ulsan National Institute of Science and Technology, 2019 – 2022

Serving as the co-principal investigator (Co-PI)
- 차세대지능형반도체기술개발사업, National Research Foundation of Korea, 2023 – Present
- 차세대지능형반도체기술개발사업, National Research Foundation of Korea, 2021 – 2023
- PIM인공지능반도체핵심기술개발(소자)사업, National Research Foundation of Korea, 2022 – Present
- 미래기술연구실, National Research Foundation of Korea, 2022 – Present
- 나노소재기술개발사업, National Research Foundation of Korea, 2020 – 2021
- 반도체특성화대학원 지원사업, Korea Institute for Advancement of Technology, 2023 – Present
- Institutional funding: 미래선도형 특성화사업, UNIST, 2020 – Present
  반도체혁신선도연구단과제, UNIST, 2022 – Present
- Industry funding: Samsung Electronics (NCFET), 2020 – 2023
  Samsung Electronics (Laser annealing), 2021 – 2024
  Samsung Electronics (Cryogenic dry etching), 2023 – Present
  SPCI, 2021 – 2023
  Tokyo Electron Ltd., 2022 – 2023

GRADUATES AND POSTDOCS SUPERVISED

Graduate Students (Currently at UNIST)
- Research Professor: Dr. Dong-Hyeok Lim
- PhD: Kyungmin Ko, Namwook Hur, Sungyeon Kim, Jeongin Yeo, Changhwan Kim, Sohui Yoon, Beomsung Park, Mingyu Jang, Hanbin Cho, Seonguk Yang, Seunghwan Kim, Youngseok Cho
- MS: Habin Baek, Jaeeun Kwon, Gayeon Lee
- BS: Changjun Park, Chanho Lee, Hyunsoo Kim, Dahyeon Park

Alumni
- Dr. Swati Singh (Former Postdoc, PhD, SKKU): Now faculty at Bangalore University, India
- Dr. Wonjun Yang (Former Postdoc, PhD, Yonsei): Now at Samsung Electronics
- Dr. Youn Ho Park (Former Postdoc, PhD, Yonsei): Now staff scientist at KAIST
- Dr. Sobia Ali Khan (Former Postdoc, PhD, Chungbuk National Univ.): Now postdoc at BIT
- Jiyoung Kim (MS, UNIST): Now at LG Electronics
- Hoyeon Cho (MS, UNIST): Now at Samsung Electronics
- Huimin Lee (MS, UNIST): Now at Samsung Electronics
- Junga Ju (MS, UNIST): Now at Applied Materials

SCIENTIFIC SERVICES AND ACTIVITIES

Editorial board memberships for
- Editor, Journal of the Korean Institute of Electrical and Electronic Material Engineers, 2020 – Present
- Guest Editor, Nanotechnology (IOP Publishing), Focus issue on "3D Micro/Nano Structures Based on Atomically Thin 2D Materials," 2020 [Link]

Conference (co-)organizer for
- Local Committee Member, IEEE Non-volatile Memory Technology Symposium (NVMTS 2024, Busan, Korea)
- "Two-dimensional materials and van der Waals heterostructures," GCIM 2024 (Jeju, Korea)
- "Functional polymer and 2D materials interfaces for optoelectronics," ACS Spring 2023 Meeting (Indianapolis, IN)
- "Nanotechnologies," IEEE EDTM 2023 (Seoul, Korea)
- "Two-dimensional materials and van der Waals heterostructures," GCIM 2023 (Jeju, Korea)
- "2D materials & vdW heterostructures: emerging properties & applications," ICAE 2023 (Jeju, Korea)

Journal reviewer for

- Nature Nanotechnology, Nature Communications, npj 2D Materials and Applications, npj Quantum Materials, Scientific Reports
- Nano Letters, ACS Nano, ACS Photonics, ACS Applied Materials & Interfaces, Chemistry of Materials, The Journal of Physical Chemistry Letters, ACS Applied Nano Materials
- Advanced Functional Materials, Small
- Nano Energy, Nanoscale, Nanotechnology, Materials Today Physics, Applied Physics Letters, Journal of Applied Physics, Journal of Physics D: Applied Physics, Ceramics International, Materials Chemistry and Physics, Thin Solid Films, Journal of Materials Chemistry C, MRS Advances, Materials Research Express, and more

Proposal reviewer for
- National Research Foundation of Korea (NRF)
- Samsung Research Funding & Incubation Center for Future Technology
- Israel Science Foundation (ISF)
- University of Vienna (REWIRE)

Professional Memberships
- Materials Research Society (MRS), American Physical Society (APS), American Vacuum Society (AVS)
- Institute of Electrical and Electronics Engineers (IEEE), IEEE Electron Devices Society
- The Korean Society of Semiconductor & Display Technology, The Korean Ceramic Society, Korean Graphene Society, The Korean Institute of Electrical and Electronic Material Engineers

TEACHING EXPERIENCES

At UNIST

- MSE354, "Introduction to Semiconductors" (Evaluation: 4.54/5.0) 2020 – Present
- SCM453, "Semiconductor Processing" (Evaluation: 4.74/5.0) 2020 – Present
- MSE554, "Nanoscale Electronic Materials" (Evaluation: 4.64/5.0) 2020 – Present
- MSE300, "Materials Lab" (Evaluation: 4.59/5.0) Fall 2021
- NME494, "Integrated Nanoelectronics for Technology" (Evaluation: 4.57/5.0) Fall 2019

JOURNAL PUBLICATIONS (**underline** indicates our group members)

In preparation

- H. Lee, S. Yang, K. Kim, S. Oh, H. Cho, H. Cho, K. Ko, N. Hur, H. Y. Jeong, B. C. Jang, **J. Suh***, "Monolithic integration of vertical monolayer MoS_2 field-effect transistor through direct growth," *in preparation* (2024).
- J. Kwon, H. Cho, K. Ko, H. Kim, S. Yang, H.-H. Cho, **J. Suh***, "Electrochemical transistor utilizing broad-range modulation of guest-species interactions with precise control of channel properties of MoS_2," *in preparation* (2024).
- S. Yoon, D.-H. Lim, N. Hur, B. Park, H. Jeong, **J. Suh***, "Deep-cryogenic phase change memory," *in preparation* (2024).

Under review

- N. Hur, Y. Kim, B. Park, S. Yoon, S. Kim, D.-H. Lim, H. Jeong, Y. Kwon, **J. Suh***, "Three-dimensionally scaled heater-all-around configuration toward low-power phase change memory, devices" *under review* (2024).
- K. Ko†, D.-H. Lim†, **J. Suh***, "Probabilistic trap-centric bulk-limited conduction model," *under review* (2024).
- S. J. Lim, T. W. Kim, T. Park, W. Lee, Y. S. Heo, S. Yang, H. Seo, **J. Suh**, J.-U. Lee, "Large-scale analysis of defects in atomically thin semiconductors using hyperspectral line imaging," *under review* (2024).

Peer-reviewed Papers

66. M. Kim, D.-E. Kim, Y. Wang, D. Lee, D.-H. Lim, H. Choi, I. Kymissis, J. J. Yang, **J. Suh***, H.-S. Lee*, H.-H. Park*, "Forming-less flexible memristor crossbar array for neuromorphic computing applications produced using low-temperature atomic layer deposition," *Applied Materials Today* 38, 102204 (2024) [Link].

65. S. Kim, W. Lee, K. Ko, H. Cho, H. Cho, S. Jeon, C. Jeong, S. Kim*, F. Ding*, **J. Suh***, "Phase-centric MOCVD enabled synthetic approaches for wafer-scale 2D tin selenides," *Advanced Materials* 2400800 (2024) [Link].

64. J. Park, S. J. Kwak, S. Kang, S. Oh, B. Shin, G. Noh, T. S. Kim, C. Kim, H. Park, S. H. Oh, W. Kang, N. Hur, H.-J. Chai, M. Kang, Y. Lee, E. Moon, C. Shi, J. Lou, W. B. Lee, J. Y. Kwak, H. Yang, T.-M. Chung, T. Eom, **J. Suh**, Y. Han, H. Y. Jeong, Y. Kim, K. Kang, "Area-selective atomic layer deposition on 2D monolayer lateral superlattices," *Nature Communications* 15, 2138 (2024) [Link].

63. K. Ko, M. Jang, J. Kwon, **J. Suh***, "Native point defects in 2D transition metal dichalcogenides: a perspective bridging intrinsic physical properties and device applications," *Journal of Applied Physics* 135, 100901 (2024) [Link].

62. S. Kim, C. Kim, N. Hur, **J. Suh***, "Advanced tellurium-based threshold switching devices for high-density memory arrays," *J. Korean Inst. Electr. Electron Mater. Eng.* 36, 547 (2023) [Link].

61. C. Kim, N. Hur, J. Yang, S. Oh, J. Yeo, H. Y. Jeong*, B. Shong*, **J. Suh***, "Atomic layer deposition route to scalable, electronic-grade van der Waals Te thin films," *ACS Nano* 17, 15776 (2023) [Link].
    - Highlighted as supplementary cover [Link].
    - Media coverages: [1] [2] [3] [4] [5]

60. S.-H. Kang, S. Yang, D. Lee, S. Kim*, **J. Suh***, H.-S. Lee*, "Investigating series and parallel oxide memtransistors for tunable weight update properties," *ACS Applied Electronic Materials* 5, 3232 (2023) [Link].

59. H. Cho, D. Lee, K. Ko, D.-Y. Lin, H. Lee, S. Park, B. Park, B. Jang, D.-H. Lim*, **J. Suh***, "Double-floating-gate van der Waals transistor for high-precision synaptic operations," *ACS Nano* 17, 7384 (2023) [Link].
    - Media coverages: [1] [2] [3] [4] [5]

58. M. Jang, S. Singh, **J. Suh***, "Anisotropic thermal conductivity in two-dimensional van der Waals crystals," *Ceramist* 26, 106 (2023) [Link].

57. J. Ju, J. Park, **J. Suh***, H. Jeong*, "Advancing dry etch process with low global warming potential gases toward carbon neutrality," *J. Korean Inst. Electr. Electron Mater. Eng.* 36, 99 (2023) [Link].

56. M. Kim, M. A. Rehman, D. Lee, Y. Wang, D.-H. Lim, M. F. Khan, H. Choi, Q. Shao, **J. Suh***, H.-S. Lee*, H.-H. Park*, "Filamentary and interface-type memristors based on tantalum oxide for energy-efficient neuromorphic hardware," *ACS Applied Materials & Interfaces* 14, 44561 (2022) [Link].

55. H. Sun†, F. Liu†, L. Zhang†, K. Ko†, B. McLean, H. An, S. Kim, M. Huang, M.-G. Willinger, R. Ruoff, **J. Suh***, Z. Wang*, F. Ding*, "Bottom-up growth of graphene nanospears and nanoribbons," *Advanced Functional Materials* 32, 2206961 (2022) [Link].

54. J. Han, B. Jeong, Y. Kim, **J. Suh**, H. Jeong, H.-M. Kim, T.-S. Yoon, "Nonvolatile memory characteristics associated with oxygen ion exchange in thin-film transistors with indium-zinc oxide channel and HfO_{2-x} gate oxide," *Materials Today Advances* 15, 100264 (2022) [Link].

53. G. Kim, H. M. Kim, P. Kumar, M. Rahaman, C. E. Stevens, J. Jeon, K. Jo, K.-H. Kim, N. Trainor, H. Zhu, B.-H. Sohn, E. A. Stach, J. R. Hendrickson, N. R. Glavin, **J. Suh**, J. M. Redwing, D. Jariwala, "High density, localized quantum emitters in strained 2D semiconductors," *ACS Nano* 16, 9651 (2022) [Link].

52. J. Kim, K. Ko, H. Kwon, **J. Suh***, H.-J. Kwon*, J.-H. Yoo*, "Channel scaling dependent photoresponse of copper-based flexible photodetectors using laser-induced oxidation," *ACS Applied Materials & Interfaces* 14, 6977 (2022) [Link].

51. S. J. Kim, D. Choi, K.-W. Kim, K.-Y. Lee, D.-H. Kim, S. Hong, **J. Suh**, C. Lee, S. K. Kim, T.-E. Park, H. C. Koo, "Interface engineering of magnetic anisotropy in van der Waals ferromagnet-based heterostructures," *ACS nano* 15, 16395 (2021) [Link].

50. S. E. Kim, F. Mujid, A. Rai, F. Eriksson, **J. Suh**, P. Poddar, A. Ray, C. Park, E. Fransson, Y. Zhong, D. A. Muller, P. Erhart, D. G. Cahill, J. Park, "Extremely anisotropic van der Waals thermal conductors," *Nature* 597, 660 (2021) [Link].

49. M. Lee, J.-H. Kang, F. Mujid, **J. Suh**, A. Ray, C. Park, D. A. Muller, J. Park, "Atomically thin, optically isotropic films with 3D nanotopography," *Nano Letters* 21, 7291 (2021) [Link].

48. H. Kwon, J. Kim, K. Ko, M. J. Matthews, **J. Suh***, H.-J. Kwon*, J.-H. Yoo*, "Laser-induced digital oxidation for copper-based flexible photodetectors," *Applied Surface Science* 540, 148333 (2021) [Link].

47. I. Oh, J. Park, D. Choe, J. Jo, H. Jeong, M.-J. Jin, J. Jo, **J. Suh**, B.-C. Min, J.-W. Yoo, "A scalable molecule-based magnetic thin film for spin-thermoelectric energy conversion," *Nature Communications* 12, 1057 (2021) [Link].

46. W. Yang†, N. Hur†, D.-H. Lim, H. Jeong, **J. Suh***, "Heterogeneously structured phase-change materials and memory," *Journal of Applied Physics* 129, 050903 (2021) [Link].

45. H. Gao, **J. Suh**, M. C. Cao, A. Y. Joe, F. Mujid, K.-H. Lee, S. Xie, P. Poddar, J.-U. Lee, K. Kang, P. Kim, J. Park, "Tuning electrical conductance of MoS_2 monolayers through substitutional doping," *Nano Letters* 20, 4095–4101 (2020) [Link].

44. Y. Zhong, B. Cheng, C. Park, A. Ray, S. Brown, F. Mujid, J.-U. Lee, H. Zhou, **J. Suh**, K.-H. Lee, A. J. Mannix, K. Kang, S. J. Sibener, D. A. Muller, J. Park, "Wafer-scale synthesis of monolayer two-dimensional porphyrin polymers for hybrid superlattices," *Science* 366, 1379–1384 (2019) [Link].

43. H. Lee, H. Jeong, **J. Suh**, W. H. Doh, J. Baik, H.-J. Shin, J.-H. Ko, J. Wu, Y.-H. Kim, J. Y. Park, "Nanoscale friction on confined water layers intercalated between MoS_2 flakes and silica," *Journal of Physical Chemistry C* 123, 8827–8835 (2019) [Link].

42. H. S. Choe, J. Li, W. Zheng, J. Lee, **J. Suh**, F. I. Allen, H. Liu, H.-J. Choi, W. Walukiewicz, H. Zheng, J. Wu, "Anomalously high electronic thermal conductivity and Lorenz ratio in Bi_2Te_3 nanoribbons far from the bipolar condition," *Applied Physics Letters* 114, 152101 (2019) [Link].

41. **J. Suh***, T. Sarkar, H. S. Choe, J. Park, T. Venkatesan, J. Wu, "Compensated thermal conductivity of metallically conductive Ta-doped TiO_2," *Applied Physics Letters* 113, 022103 (2018) [Link].

40. Y. Chen, C. Chen, R. Kealhofer, H. Liu, Z. Yuan, L. Jiang, **J. Suh**, J. Park, C. Ko, H. S. Choe, J. Avila, M. Zhong, Z. Wei, J. Li, S. Li, Y. Liu, H. Gao, J. Analytis, M. C. Asensio, Q. Xia, J. Wu, "Black arsenic: A layered semiconductor with extreme in-plane anisotropy," *Advanced Materials* 30, 1800754 (2018) [Link].

39. **J. Suh***, T. L. Tan, W. Zhao, J. Park, D.-Y. Lin, T.-E. Park, J. Kim, C. Jin, N. Saigal, S. Ghosh, Z. Wong, Y. Chen, F. Wang, W. Walukiewicz, G. Eda, J. Wu, "Reconfiguring crystal and electronic structures of MoS_2 by substitutional doping," *Nature Communications* 9, 199 (2018) [Link].

38. H. Liu, H. S. Choe, Y. Chen, **J. Suh**, C. Ko, S. Tongay, J. Wu, "Variable range hopping electric and thermoelectric transport in anisotropic black phosphorus," *Applied Physics Letters* 111, 102101 (2017) [Link].

37. P. Ci, Y. Chen, J. Kang, R. Suzuki, H. S. Choe, **J. Suh**, C. Ko, T. Park, K. Shen, Y. Iwasa, S. Tongay, J. W. Ager, L.-W. Wang, J. Wu, "Quantifying van der Waals interactions in layered transition metal dichalcogenides from pressure-enhanced valence band splitting," *Nano Letters* 17, 4982–4988 (2017) [Link].

36. H. S. Choe, **J. Suh**, C. Ko, K. Dong, S. Lee, J. Park, Y. Lee, K. Wang, J. Wu, "Enhancing modulation of thermal conduction in vanadium dioxide thin film by nanostructured nanogaps," *Scientific Reports* 7, 7131 (2017) [Link].

35. S. Lee, K. Hippalgaonkar, F. Yang, J. Hong, C. Ko, **J. Suh**, K. Liu, K. Wang, J. J. Urban, X. Zhang, C. Dames, S. A. Hartnoll, O. Delaire, J. Wu, "Anomalously low electronic thermal conductivity in metallic vanadium dioxide," *Science* 355, 371–374 (2017) [Link].

    - "For this metal, electricity flows, but not the heat," LBNL News Center [Link], Forbes [Link].
    - Rated as the #1 science story of Lawrence Berkeley National Laboratory in 2017 [Link].
    - Also highlighted on the Office of Science website.

34. C. Jin, J. Kim, **J. Suh**, Z. Shi, B. Chen, X. Fan, M. Kam, K. Watanabe, T. Taniguchi, S. Tongay, J. Wu, A. Zettl, F. Wang, "Interlayer electron-phonon coupling in WSe_2/hBN heterostructures," *Nature Physics* 13, 127–131 (2017) [Link].

33. N. J. Borys, E. S. Barnard, S. Gao, K. Yao, W. Bao, A. Buyanin, Y. Zhang, S. Tongay, C. Ko, **J. Suh,** A. Weber-Bargioni, J. Wu, L. Yang, P. J. Schuck, "Anomalous above-gap photoexcitations and optical signatures of localized charge puddles in monolayer molybdenum disulfide," *ACS Nano* 11, 2115–2123 (2017) [Link].

32. C. Jin, J. Kim, K. Wu, B. Chen, E. S. Barnard, **J. Suh**, Z. Shi, S. G. Drapcho, J. Wu, P. J. Schuck, S. Tongay, F. Wang, "On optical dipole moment and radiative recombination lifetime of excitons in WSe_2," *Advanced Functional Materials* 27, 1601741 (2017) [Link].

31. T.-S. Ko, Z.-W. Chen, D.-Y. Lin, **J. Suh**, Z.-S. Chen, "Observation of persistent photoconductivity in Ni-doped MoS_2," *Japanese Journal of Applied Physics* 56, 04CP09 (2017) [Link].

30. J. Kim, M. E. Khan, J.-H. Ko, J. H. Kim, E.-S. Lee, **J. Suh**, J. Wu, Y.-H. Kim, J. Y. Park, H.-K. Lyeo, "Bimodal control of heat transport at graphene–metal interfaces using disorder in graphene," *Scientific Reports* 6, 34428 (2016) [Link].

29. J.-H. Yoo, M. Menor, J. Adams, R. N. Raman, J. R. I. Lee, T. Olson, N. Shen, **J. Suh**, S. Demos, J. Bude, S. Elhadj, "Laser damage mechanisms in conductive widegap semiconductor films," *Optics Express* 24, 17616–17634 (2016) [Link].

28. E. Kim, C. Ko, K. Kim, Y. Chen, **J. Suh**, S.-G. Ryu, K. Wu, X. Meng, A. Suslu, S. Tongay, J. Wu, C. P. Grigoropoulos, "Site selective doping of ultrathin metal dichalcogenides by laser-assisted reaction," *Advanced Materials* 28, 341 (2016) [Link].

    - Highlighted as back cover [Link].

27. M. Brotons-Gisbert, D. Andres-Penares, **J. Suh**, F. Hidalgo, R. Abargues, P. J. Rodriguez-Canto, A. Segura, A. Cros, G. Tobias, E. Canadell, P. Ordejon, J. Wu, J. P. Martinez-Pastor, J. F. Sanchez-Royo, "Nanotexturing to enhance photoluminescence response of atomically thin indium selenide with highly tunable band gap," *Nano Letters* 16, 3221–3229 (2016) [Link].

26. Y. Liu, K. Tom, X. Wang, C. Huang, H. Yuan, H. Ding, C. Ko, **J. Suh**, L. Pan, K. A. Persson, J. Yao, "Dynamic control of optical response in layered metal chalcogenide nanoplates," *Nano Letters* 16, 488–496 (2016) [Link].

25. C. Ko, Y. Lee, Y. Chen, **J. Suh**, D. Fu, A. Suslu, S. Lee, J. D. Clarkson, H. S. Choe, S. Tongay, R. Ramesh, J. Wu, "Ferroelectrically gated atomically thin transition-metal dichalcogenides as nonvolatile memory," *Advanced Materials* 28, 2923–2930 (2016) [Link].

24. Y. Chen, S. Zhang, W. Gao, F. Ke, J. Yan, B. Saha, C. Ko, **J. Suh**, B. Chen, J. W. Ager, W. Walukiewicz, R. Jeanloz, J. Wu, "Pressure-induced structural transition of $Cd_xZn_{1-x}O$ alloys," *Applied Physics Letters* 108, 152108 (2016) [Link].

23. **J. Suh**, K. M. Yu, D. Fu, X. Liu, F. Yang, J. Fan, D. J. Smith, Y.-H. Zhang, J. K. Furdyna, C. Dames, W. Walukiewicz, J. Wu, "Simultaneous enhancement of electrical conductivity and thermopower of Bi_2Te_3 by multi-functionality of native defect," *Advanced Materials* 27, 3681–3686 (2015) [Link].

    - "Defects can hulk-up materials," LBNL News Center [Link], R&D Magazine [Link].
    - Also highlighted on the Office of Science website.

22. S. Lee, F. Yang, **J. Suh**, S. Yang, Y. Lee, G. Li, H. S. Choe, A. Suslu, Y. Chen, C. Ko, J. Park, K. Liu, J. Li, K. Hippalgaonkar, J. J. Urban, S. Tongay, J. Wu, "Anisotropic in-plane thermal conductivity of black phosphorus nanoribbons at temperatures higher than 100K," *Nature Communications* 6, 8573 (2015) [Link].

    - "Is black phosphorous the next big thing in materials?" LBNL News Center [Link].

21. W. Bao, N. J. Borys, C. Ko, **J. Suh**, W. Fan, A. Thron, Y. Zhang, A. Buyanin, J. Zhang, S. Cabrini, P. D. Ashby, A. Weber-Bargioni, S. Tongay, S. Aloni, D. F. Ogletree, J. Wu, M. B. Salmeron, P. J. Schuck, "Visualizing nanoscale excitonic relaxation properties of disordered edges and grain boundaries in monolayer molybdenum disulfide," *Nature Communications* 6, 7993 (2015) [Link].

    - "Surprising discoveries about 2D molybdenum disulfide," LBNL News Center [Link].

20. K. Liu, C.-L. Hsin, D. Fu, **J. Suh**, S. Tongay, M. Chen, Y. Sun, A. Yan, J. Park, K. M. Yu, W. Guo, A. Zettl, H. Zheng, D. Chrzan, J. Wu, "Self-passivation of defects: effects of high-energy particle irradiation on the elastic modulus of multilayer graphene," *Advanced Materials* 27, 6841 (2015) [Link].

19. T.-E. Park, **J. Suh**, D. Seo, J. Park, D.-Y. Lin, Y.-S. Huang, H.-J. Choi, J. Wu, C. Jang, J. Chang, "Hopping conduction in *p*-type MoS_2 near the critical regime of the metal-insulator transition," *Applied Physics Letters* 107, 223107 (2015) [Link].

18. M. Song, J.-H. Chu, J. Zhou, S. Tongay, K. Liu, **J. Suh**, H. Chen, J. S. Kang, X. Zou, L. You, "Magnetoresistance oscillations in topological insulator Bi_2Te_3 nanoscale antidot arrays," *Nanotechnology* 26, 265301 (2015) [Link].

17. **J. Suh**, T.-E. Park, D.-Y. Lin, D. Fu, J. Park, H. J. Jung, Y. Chen, C. Ko, C. Jang, Y. Sun, R. Sinclair, J. Chang, S. Tongay, J. Wu, "Doping against the native propensity of MoS_2: degenerate hole doping by cation substitution," *Nano Letters* 14, 6976–6982 (2014) [Link].

    - "TMD gets *p*-doped," Nanotechweb.org [Link].

16. T. Favaloro†, **J. Suh**†, B. Vermeersch, K. Liu, Y. Gu, L.-Q. Chen, K. X. Wang, J. Wu, A. Shakouri, "Direct observation of nanoscale Peltier and Joule effects at metal-insulator domain walls in vanadium dioxide nanobeams," *Nano Letters* 14, 2394–2400 (2014) [Link].

15. **J. Suh**, D. Fu, X. Liu, J. K. Furdyna, K. M. Yu, W. Walukiewicz, J. Wu, "Fermi-level stabilization in topological insulators Bi_2Se_3 and Bi_2Te_3: origin of the surface electron gas," *Physical Review B* 89, 115307 (2014) [Link].

14. K. Liu, C. Cheng, **J. Suh**, R. Tang-Kong, D. Fu, S. Lee, J. Zhou, L. O. Chua, J. Wu, "Powerful, multifunctional torsional micro muscles activated by phase transition," *Advanced Materials* 26, 1746–1750 (2014) [Link].

13. S. Tongay, W. Fan, J. Kang, J. Park, U. Koldemir, **J. Suh**, D. S. Narang, K. Liu, J. Ji, J. Li, R. Sinclair, J. Wu, "Tuning interlayer coupling in large-area heterostructures with CVD-grown MoS_2 and WS_2 monolayers," *Nano Letters* 14, 3185–3190 (2014) [Link].

12. K. Liu, Q. Yan, M. Chen, W. Fan, Y. Sun, **J. Suh**, D. Fu, S. Lee, J. Zhou, S. Tongay, J. Ji, J. B. Neaton, J. Wu, "Elastic properties of chemical-vapor-deposited monolayer MoS_2, WS_2, and their bilayer heterostructures," *Nano Letters* 14, 5097–5103 (2014) [Link].

11. S. Horzum, D. Çakır, **J. Suh**, S. Tongay, Y.-S. Huang, C.-H. Ho, J. Wu, H. Sahin, F. M. Peeters, "Formation and stability of point defects in monolayer rhenium disulfide," *Physical Review B* 89, 155433 (2014) [Link].

10. S. Tongay, D. S. Narang, J. Kang, W. Fan, C. Ko, A. V. Luce, K. X. Wang, **J. Suh**, K. D. Patel, V. M. Pathak, J. Li, J. Wu, "Two-dimensional semiconductor alloys: monolayer $Mo_{1-x}W_xSe_2$," *Applied Physics Letters* 104, 012101 (2014) [Link].

9. S. Tongay†, **J. Suh**†, C. Ataca, W. Fan, A. Luce, J. S. Kang, J. Liu, C. Ko, J. Zhou, J. Li, J. C. Grossman, J. Wu, "Defects activated photoluminescence in two-dimensional semiconductors: interplay between bound, charged, and free excitons," *Scientific Reports* 3, 2657 (2013) [Link].

- "Top 100 Most Cited Article," Scientific Report (28th most cited over 7,000 papers).
- "Defects help enhance photoluminescence in 2D semicondutors," Nanotechweb.org [Link].
- "Defects in 2D semiconductors could lead to multi-colored light-emitting devices," Phys.org [Link].

8. S. Lee, C. Cheng, H. Guo, K. Hippalgaonkar, K. Wang, **J. Suh**, K. Liu, J. Wu, "Axially engineered metal-insulator phase transition by graded doping VO_2 nanowires," *Journal of the American Chemical Society* 135, 4850–4855 (2013) [Link].

7. J.-H. Kim, J. Hwang, **J. Suh**, S. Tongay, S. Kwon, C. C. Hwang, J. Wu, J. Y. Park, "Work function engineering of single layer graphene by irradiation-induced defects," *Applied Physics Letters* 103, 171604 (2013) [Link].

6. C.-L. Hsin, M. C. Wingert, C.-W. Huang, H. Guo, T.-J. Shih, **J. Suh**, K. Wang, J. Wu, W.-W. Wu, R. Chen, "Phase transformation and thermoelectric properties of bismuth-telluride nanowires," *Nanoscale* 5, 4669–4672 (2013) [Link].

5. K. Liu, D. Fu, J. Cao, **J. Suh**, K. X. Wang, C. Cheng, D. F. Ogletree, H. Guo, S. Sengupta, A. Khan, C. W. Yeung, S. Salahuddin, M. M. Deshmukh, J. Wu, "Dense electron system from gate-controlled surface metal-insulator transition," *Nano Letters* 12, 6272–6277 (2012) [Link].

4. C. Miller, M. Triplett, J. Lammatao, **J. Suh**, D. Fu, J. Wu, D. Yu, "Unusually long minority carrier lifetime and metal-insulator band offset in vanadium dioxide," *Physical Review B* 85, 085111 (2012) [Link].

3. C. Cheng, K. Liu, B. Xiang, **J. Suh**, J. Wu, "Ultra-long, free-standing, single-crystalline vanadium dioxide micro/nanowires grown by simple thermal evaporation," *Applied Physics Letters* 100, 103111 (2012) [Link].

2. A. X. Levander, T. Tong, K. M. Yu, **J. Suh**, D. Fu, R. Zhang, H. Lu, W. J. Schaff, O. Dubon, W. Walukiewicz, D. G. Cahill, J. Wu, "Effects of point defects on thermal and thermoelectric properties of InN," *Applied Physics Letters* 98, 012108 (2011) [Link].

1. H.-S. Kim, K.-B. Park, K. S. Son, J. S. Park, W.-J. Maeng, T. S. Kim, K.-H. Lee, E. S. Kim, J. Lee, **J. Suh**, J.-B. Seon, M. K. Ryu, S. Y. Lee, K. Lee, S. Im, "The influence of sputtering power and O_2/Ar flow ratio on the performance and stability of Hf-In-Zn-O thin film transistors under illumination," *Applied Physics Letters* 97, 102103 (2010) [Link].

PATENTS

International Patents

- "Memristor-based array device performing three-dimensional convolutional neural network (3D CNN) operation and 3D CNN operation method using the device," PCT/KR2024/004908 *filed* (2024).
- "Reservoir computing devices and method using volatile synapse devices," PCT/KR2024/004478 *filed* (2024).
- "Fabrication of two-dimensional semiconductor quantum dot array," PCT/KR2023/008945 *filed* (2023).
- "Phase-change memory device," PCT/KR2023/003835 *filed* (2023).
- "Wafer-scale production method of tin selenides via metal-organic chemical vapor deposition," PCT/KR2023/002461 *filed* (2023).
- "Anisotropic thermal conductors," US Patent 17/884,115 *filed* (2022).
- "Capacitor using high-k hydrocarbon thin film and semiconductor device using the same," PCT/KR2021/007770 *filed* (2023).
- "High-k hydrocarbon thin film and semiconductor device using the same," PCT/KR2021/007769 *filed* (2023).
- "High-k hydrocarbon thin film and semiconductor device using the same," PCT/KR2021/007766 *filed* (2023).

Domestic Patents

- "2-dimension tunneling transistor and manufacturing method thereof," 10-2023-0171361 *filed* (2023).
- "Concentration/location controllable in-situ substitutional doping method in 2D materials via pulsed-MOCVD," 10-2023-0171003 *filed* (2023).
- "Junctionless field-effect transistor and CMOS device," 10-2023-0121378 *filed* (2023).
- "Reservoir computing devices and method using volatile synapse devices," 10-2023-0107103 *filed* (2023).
- "Two-dimensional semiconductor based vertical nonvolatile charge trap memory device and its manufacturing method," 10-2023-0102389 *filed* (2023).
- "Selector-integrated phase change memory element and operation method thereof," 10-2023-0094273 *filed* (2023).
- "Memristor-based array device performing three-dimensional convolutional neural network(3D CNN) operation and 3D CNN operation method using the device," 10-2023-0092525 *filed* (2023).
- "Double floating gate memory device and method of manufacturing the same," 10-2022-0174995 *filed* (2022).
- "Wafer-scale production method of tin selenides via metal-organic chemical vapor deposition," 10-2022-0174178 *filed* (2022).
- "Production method of atomic layer deposited mono-elemental tellurium thin film and fabrication method of selector using tellurium thin film," 10-2022-0157515 *filed* (2022).
- "Phase-change memory device," 10-2022-0142466 *filed* (2022).
- "Fabrication of two-dimensional semiconductor quantum dot array," 10-2022-0118525 *filed* (2022).
- "High-k hydrocarbon thin film and semiconductor device using the same," 10-2387926 *registered* (2022).
- "High-k hydrocarbon thin film and semiconductor device using the same," 10-2387925 *registered* (2022).
- "Capacitor using high-k hydrocarbon thin film and semiconductor device using the same," 10-2375281 *registered* (2022).
- "Processing apparatus based on phase-change memory device and neuromorphic system having the same," 10-2021-0050023 *filed* (2021).

INVITED/KEYNOTE TALKS AND DEPARTMENT SEMINARS

Invited Conference Presentations

- 2024 MRS (Materials Research Society) Fall Meeting, Dec. 2024
- 2024 Advanced Epitaxy for Freestanding Membranes and 2D Materials (AEFM), Jul. 2024
- 2024 Spring Meeting of The Korean Ceramic Society, Apr. 2024
- 2023 Advanced Epitaxy for Freestanding Membranes and 2D Materials (AEFM), Jul. 2023
- 2023 KPS (Korean Physical Society) Spring Meeting, Apr. 2023
- 152nd TMS (The Minerals, Metals & Materials Society) Annual Meeting, Mar. 2023
- 7th IEEE EDTM (Electron Devices Technology and Manufacturing) Conference, Mar. 2023
- International Conference on Electronic Materials and Nanotechnology for Green Environment (ENGE) 2022, Nov. 2022
- 2022 Fall Meeting of The Korean Ceramic Society, Oct. 2022
- International Conference on Advanced Materials and Devices (ICAMD) 2021, Dec. 2021
- International Union of Materials Research Societies - International Conference 2021 (IUMRS-ICA), Oct. 2021
- 2021 International Conference on Quantum Computing, Jul. 2021
- 2021 Spring Meeting of The Korean Ceramic Society, Jun. 2021
- The 28th Korean Conference on Semiconductors, Jan. 2021
- 2020 Graphene Symposium, Sep. 2020
- 2020 Spring Meeting of The Korean Ceramic Society, Jul. 2020
- The 27th Korean Conference on Semiconductors, Jan. 2020
- A3 Symposium on Functionalization and Flexible Device Application of Atomic Scale Organic and Inorganic Material, Nov. 2019

Department and Industrial Seminars

- Department of Chemical Engineering, POSTECH, Dec. 2023
- Department of Materials Science and Engineering, Kyungpook National University, Nov. 2023
- Tokyo Electron Ltd., Sep. 2023
- SK Hynix, Sep. & May 2023
- Tokyo Electron Ltd., Mar. 2023
- Tokyo Electron Ltd., Oct. 2022
- Institute for Basic Science (IBS), SKKU, Oct. 2022
- SK Hynix, Jun. 2022
- Department of Materials Science and Engineering, Hongik University, May 2022
- Department of Nanotechnology & Advanced Materials Engineering, Sejong University, Mar. 2022
- Department of Chemical Engineering, Hongik University, Feb. 2022
- Samsung Advanced Institute of Technology (SAIT), Oct. 2021
- Department of Applied Physics, Sookmyung Women's University, Oct. 2021
- Samsung Advanced Institute of Technology (SAIT), Aug. 2021
- Department of Mechanical Engineering, POSTECH, Jun. 2021
- Department of Materials Science and Engineering, Seoul National University, Dec. 2020
- Department of Physics, Ajou University, Nov. 2020
- Department of Materials Science and Engineering, UNIST, May 2020
- Department of Applied Physics, Sookmyung Women's University, Dec. 2019