

References

- Agrawal, A., Kumar, R., Venkatesan, S., Zakhidov, A., Zhu, Z., Bao, J., Kumar, M., and Kumar, M. (2017). "Fast detection and low power hydrogen sensor using edge-oriented vertically aligned 3-D network of MoS₂ flakes at room temperature". *Applied Physics Letters*, Vol. 111, pp. 093102.
- Ajayan, P., Kim, P., and Banerjee, K. (2016). "van der Waals materials". *Physics Today*, Vol. 69, pp. 9-38.
- Alam, M. S., Lin, J., and Saito, M. (2011). "First-principles calculation of the interlayer distance of the two-layer graphene". *Japanese Journal of Applied Physics*, Vol. 50, pp. 080213.
- Alev, O., Kılıç, A., Çakırlar, Ç., Büyükköse, S., and Öztürk, Z. (2018). "Gas Sensing Properties of p-Co₃O₄/n-TiO₂ Nanotube Heterostructures". *Sensors*, Vol. 18, pp. 956.
- Allain, A., Kang, J., Banerjee, K., and Kis, A. (2015). "Electrical contacts to two-dimensional semiconductors". *Nature Materials*, Vol. 14, pp. 1195.
- Anderson, R. (1960). "Germanium-gallium arsenide heterojunctions [letter to the editor]". *IBM Journal of Research and Development*, Vol. 4, pp. 283-287.
- Azulai, D., Givan, U., Shpaisman, N., Belenkova, T. L., Gilon, H., Patolsky, F., and Markovich, G. (2012). "On-surface formation of metal nanowire transparent top electrodes on CdSe nanowire array-based photoconductive devices". *ACS applied materials & interfaces*, Vol. 4, pp. 3157-3162.
- Barkan, T. (2019). "Graphene: the hype versus commercial reality". *Nature nanotechnology*, Vol. 14, pp. 904-906.
- Baugher, B. W. H., Churchill, H. O. H., Yang, Y., and Jarillo-Herrero, P. (2014). "Optoelectronic devices based on electrically tunable p-n diodes in a monolayer dichalcogenide". *Nat Nano*, Vol. 9, pp. 262-267.
- Bernardi, M., Palummo, M., and Grossman, J. C. (2013). "Extraordinary sunlight absorption and one nanometer thick photovoltaics using two-dimensional monolayer materials". *Nano letters*, Vol. 13, pp. 3664-3670.
- Bhat, T. N., Kumar, M., Rajpalke, M. K., Roul, B., Krupanidhi, S., and Sinha, N. (2011). "Band alignment studies in InN/p-Si (100) heterojunctions by x-ray photoelectron spectroscopy". *Journal of Applied Physics*, Vol. 109, pp. 123707.
- Bhimanapati, G. R., Lin, Z., Meunier, V., Jung, Y., Cha, J., Das, S., Xiao, D., Son, Y., Strano, M. S., and Cooper, V. R. (2015). "Recent advances in two-dimensional materials beyond graphene". *ACS nano*, Vol. 9, pp. 11509-11539.
- Bonaccorso, F., Sun, Z., Hasan, T., and Ferrari, A. (2010). "Graphene photonics and optoelectronics". *Nature photonics*, Vol. 4, pp. 611.
- Cai, Z., Liu, B., Zou, X., and Cheng, H.-M. (2018). "Chemical vapor deposition growth and applications of two-dimensional materials and their heterostructures". *Chemical reviews*, Vol. 118, pp. 6091-6133.
- Califano, M. (2009). "Direct and inverse auger processes in InAs nanocrystals: can the decay signature of a trion be mistaken for carrier multiplication?". *Acs Nano*, Vol. 3, pp. 2706-2714.
- Califano, M., Zunger, A., and Franceschetti, A. (2004). "Efficient inverse Auger recombination at threshold in CdSe nanocrystals". *Nano Letters*, Vol. 4, pp. 525-531.
- Canton-Vitoria, R., Sayed-Ahmad-Baraza, Y., Pelaez-Fernandez, M., Arenal, R., Bittencourt, C., Ewels, C. P., and Tagmatarchis, N. (2017). "Functionalization of MoS₂ with 1, 2-dithiolanes: toward donor-acceptor nanohybrids for energy conversion". *npj 2D Materials and Applications*, Vol. 1, pp. 13.
- Chen, C.-C., Aykol, M., Chang, C.-C., Levi, A., and Cronin, S. B. (2011). "Graphene-silicon Schottky diodes". *Nano letters*, Vol. 11, pp. 1863-1867.
- Chen, C.-F., Park, C.-H., Boudouris, B. W., Horng, J., Geng, B., Girit, C., Zettl, A., Crommie, M. F., Segalman, R. A., and Louie, S. G. (2011). "Controlling inelastic light scattering quantum pathways in graphene". *Nature*, Vol. 471, pp. 617-620.
- Chen, C., Feng, Z., Feng, Y., Yue, Y., Qin, C., Zhang, D., and Feng, W. (2016). "Large-scale synthesis of a uniform film of bilayer MoS₂ on graphene for 2D heterostructure phototransistors". *ACS applied materials & interfaces*, Vol. 8, pp. 19004-19011.
- Chen, C., Qiao, H., Lin, S., Luk, C. M., Liu, Y., Xu, Z., Song, J., Xue, Y., Li, D., and Yuan, J. (2015). "Highly responsive MoS₂ photodetectors enhanced by graphene quantum dots". *Scientific reports*, Vol. 5, pp. 11830.

- Chen, Y., Jiang, G., Chen, S., Guo, Z., Yu, X., Zhao, C., Zhang, H., Bao, Q., Wen, S., and Tang, D. (2015). "Mechanically exfoliated black phosphorus as a new saturable absorber for both Q-switching and mode-locking laser operation". *Optics express*, Vol. 23, pp. 12823-12833.
- Chhowalla, M., Liu, Z., and Zhang, H. (2015). "Two-dimensional transition metal dichalcogenide (TMD) nanosheets". *Chemical Society Reviews*, Vol. 44, pp. 2584-2586.
- Chhowalla, M., Shin, H. S., Eda, G., Li, L.-J., Loh, K. P., and Zhang, H. (2013). "The chemistry of two-dimensional layered transition metal dichalcogenide nanosheets". *Nature chemistry*, Vol. 5, pp. 263.
- Chiu, M.-H., Zhang, C., Shiu, H.-W., Chuu, C.-P., Chen, C.-H., Chang, C.-Y. S., Chen, C.-H., Chou, M.-Y., Shih, C.-K., and Li, L.-J. (2015). "Determination of band alignment in the single-layer MoS₂/WSe₂ heterojunction". *Nature communications*, Vol. 6, pp. 1-6.
- Cho, B., Kim, A. R., Park, Y., Yoon, J., Lee, Y.-J., Lee, S., Yoo, T. J., Kang, C. G., Lee, B. H., and Ko, H. C. (2015). "Bifunctional sensing characteristics of chemical vapor deposition synthesized atomic-layered MoS₂". *ACS applied materials & interfaces*, Vol. 7, pp. 2952-2959.
- Cho, B., Yoon, J., Lim, S. K., Kim, A. R., Kim, D.-H., Park, S.-G., Kwon, J.-D., Lee, Y.-J., Lee, K.-H., and Lee, B. H. (2015). "Chemical sensing of 2D graphene/MoS₂ heterostructure device". *ACS applied materials & interfaces*, Vol. 7, pp. 16775-16780.
- Choi, M. S., Qu, D., Lee, D., Liu, X., Watanabe, K., Taniguchi, T., and Yoo, W. J. (2014). "Lateral MoS₂ p-n junction formed by chemical doping for use in high-performance optoelectronics". *ACS nano*, Vol. 8, pp. 9332-9340.
- Choi, W., Cho, M. Y., Konar, A., Lee, J. H., Cha, G. B., Hong, S. C., Kim, S., Kim, J., Jena, D., and Joo, J. (2012). "High-detectivity multilayer MoS₂ phototransistors with spectral response from ultraviolet to infrared". *Advanced materials*, Vol. 24, pp. 5832-5836.
- Chou, W.-Y., Lin, Y.-S., Kuo, L.-L., Liu, S.-J., Cheng, H.-L., and Tang, F.-C. (2014). "Light sensing in photosensitive, flexible n-type organic thin-film transistors". *Journal of Materials Chemistry C*, Vol. 2, pp. 626-632.
- Chu, T., Ilatikhameneh, H., Klimeck, G., Rahman, R., and Chen, Z. (2015). "Electrically tunable bandgaps in bilayer MoS₂". *Nano letters*, Vol. 15, pp. 8000-8007.
- Cracknell, R. F., Alcock, J. L., Rowson, J. J., Shirvill, L. C., and Üngüt, A. (2002). "Safety considerations in retailing hydrogen". *SAE Transactions*, Vol., pp. 922-926.
- Crowell, C., and Sze, S. (1966). "Current transport in metal-semiconductor barriers". *Solid-state electronics*, Vol. 9, pp. 1035-1048.
- Deokar, G., Vancsó, P., Arenal, R., Ravoux, F., Casanova-Cháfer, J., Llobet, E., Makarova, A., Vyalikh, D., Struzzi, C., and Lambin, P. (2017). "MoS₂-Carbon nanotube hybrid material growth and gas sensing". *Advanced Materials Interfaces*, Vol. 4, pp. 1700801.
- Dhakal, C., Aryal, S., Sakidja, R., and Ching, W.-Y. (2015). "Approximate lattice thermal conductivity of MAX phases at high temperature". *Journal of the European Ceramic Society*, Vol. 35, pp. 3203-3212.
- Donarelli, M., Prezioso, S., Perrozzi, F., Bisti, F., Nardone, M., Giancaterini, L., Cantalini, C., and Ottaviano, L. (2015). "Response to NO₂ and other gases of resistive chemically exfoliated MoS₂-based gas sensors". *Sensors and Actuators B: Chemical*, Vol. 207, pp. 602-613.
- Dwivedi, P., Das, S., and Dhanekar, S. (2017). "Wafer-Scale Synthesized MoS₂/Porous Silicon Nanostructures for Efficient and Selective Ethanol Sensing at Room Temperature". *ACS applied materials & interfaces*, Vol. 9, pp. 21017-21024.
- Echtermeyer, T. J., Lemme, M. C., Baus, M., Szafranek, B. N., Geim, A. K., and Kurz, H. (2008). "Nonvolatile switching in graphene field-effect devices". *IEEE Electron Device Letters*, Vol. 29, pp. 952-954.
- Fang, Y., Armin, A., Meredith, P., and Huang, J. (2019). "Accurate characterization of next-generation thin-film photodetectors". *Nat. Photonics*, Vol. 13, pp. 1-4.
- Favron, A., Gaufrès, E., Fossard, F., Phaneuf-L'Heureux, A.-L., Tang, N. Y., Lévesque, P. L., Loiseau, A., Leonelli, R., Francoeur, S., and Martel, R. (2015). "Photooxidation and quantum confinement effects in exfoliated black phosphorus". *Nature materials*, Vol. 14, pp. 826-832.
- Feng, B., Zhang, J., Zhong, Q., Li, W., Li, S., Li, H., Cheng, P., Meng, S., Chen, L., and Wu, K. (2016). "Experimental realization of two-dimensional boron sheets". *Nature chemistry*, Vol. 8, pp. 563.
- Furchi, M. M., Polyushkin, D. K., Pospischil, A., and Mueller, T. (2014). "Mechanisms of photoconductivity in atomically thin MoS₂". *Nano letters*, Vol. 14, pp. 6165-6170.
- Ganatra, R., and Zhang, Q. (2014). "Few-layer MoS₂: a promising layered semiconductor". *ACS nano*, Vol. 8, pp. 4074-4099.
- Gao, L. (2017). "Flexible device applications of 2D semiconductors". *Small*, Vol. 13, pp. 1603994.

- Geim, A. K., and Novoselov, K. S. (2010). The rise of graphene. In "Nanoscience and technology: a collection of reviews from nature journals", pp. 11-19. World Scientific.
- Gioannetti, G., Khomyakov, P. A., Brocks, G., Kelly, P. J., and Van Den Brink, J. (2007). "Substrate-induced band gap in graphene on hexagonal boron nitride: Ab initio density functional calculations". *Physical Review B*, Vol. 76, pp. 073103.
- Goel, N., Kumar, R., Jain, S. K., Rajamani, S., Roul, B., Gupta, G., Kumar, M., and Krupanidhi, S. (2019). "A high-performance hydrogen sensor based on a reverse-biased MoS₂/GaN heterojunction". *Nanotechnology*, Vol. 30, pp. 314001.
- Goel, N., Kumar, R., Mishra, M., Gupta, G., and Kumar, M. (2018). "Determination of band alignment at two-dimensional MoS₂/Si van der Waals heterojunction". *Journal of Applied Physics*, Vol. 123, pp. 225301.
- Goel, N., Kumar, R., Roul, B., Kumar, M., and Krupanidhi, S. (2018). "Wafer-scale synthesis of a uniform film of few-layer MoS₂ on GaN for 2D heterojunction ultraviolet photodetector". *Journal of Physics D: Applied Physics*, Vol. 51, pp. 374003.
- Gong, X., Tong, M., Xia, Y., Cai, W., Moon, J. S., Cao, Y., Yu, G., Shieh, C.-L., Nilsson, B., and Heeger, A. J. (2009). "High-detectivity polymer photodetectors with spectral response from 300 nm to 1450 nm". *Science*, Vol. 325, pp. 1665-1667.
- Gong, Y., Lin, J., Wang, X., Shi, G., Lei, S., Lin, Z., Zou, X., Ye, G., Vajtai, R., and Yakobson, B. I. (2014). "Vertical and in-plane heterostructures from WS₂/MoS₂ monolayers". *Nature materials*, Vol. 13, pp. 1135-1142.
- Gong, Y., Lin, J., Wang, X., Shi, G., Lei, S., Lin, Z., Zou, X., Ye, G., Vajtai, R., and Yakobson, B. I. (2014). "Vertical and in-plane heterostructures from WS₂/MoS₂ monolayers". *Nature materials*, Vol. 13, pp. 1135.
- Guo, F., Yang, B., Yuan, Y., Xiao, Z., Dong, Q., Bi, Y., and Huang, J. (2012). "A nanocomposite ultraviolet photodetector based on interfacial trap-controlled charge injection". *Nature nanotechnology*, Vol. 7, pp. 798-802.
- Gupta, A., Sakthivel, T., and Seal, S. (2015). "Recent development in 2D materials beyond graphene". *Progress in Materials Science*, Vol. 73, pp. 44-126.
- Hong, X., Kim, J., Shi, S.-F., Zhang, Y., Jin, C., Sun, Y., Tongay, S., Wu, J., Zhang, Y., and Wang, F. (2014). "Ultrafast charge transfer in atomically thin MoS₂/WS₂ heterostructures". *Nature nanotechnology*, Vol. 9, pp. 682-686.
- Hua, X., Ma, X., Hu, J., He, H., Xu, G., Huang, C., and Chen, X. (2018). "Controlling electronic properties of MoS₂/graphene oxide heterojunctions for enhancing photocatalytic performance: the role of oxygen". *Physical Chemistry Chemical Physics*, Vol. 20, pp. 1974-1983.
- Huang, H., Gong, H., Chow, C. L., Guo, J., White, T. J., Tse, M. S., and Tan, O. K. (2011). "Low-Temperature Growth of SnO₂ Nanorod Arrays and Tunable n-p-n Sensing Response of a ZnO/SnO₂ Heterojunction for Exclusive Hydrogen Sensors". *Advanced Functional Materials*, Vol. 21, pp. 2680-2686.
- Huang, M., Li, S., Zhang, Z., Xiong, X., Li, X., and Wu, Y. (2017). "Multifunctional high-performance van der Waals heterostructures". *Nature nanotechnology*, Vol. 12, pp. 1148.
- Huang, Y., Sutter, E., Shi, N. N., Zheng, J., Yang, T., Englund, D., Gao, H.-J., and Sutter, P. (2015). "Reliable exfoliation of large-area high-quality flakes of graphene and other two-dimensional materials". *ACS nano*, Vol. 9, pp. 10612-10620.
- Huo, N., Kang, J., Wei, Z., Li, S. S., Li, J., and Wei, S. H. (2014). "Novel and enhanced optoelectronic performances of multilayer MoS₂-WS₂ heterostructure transistors". *Advanced Functional Materials*, Vol. 24, pp. 7025-7031.
- Jariwala, D., Howell, S. L., Chen, K.-S., Kang, J., Sangwan, V. K., Filippone, S. A., Turrisi, R., Marks, T. J., Lauhon, L. J., and Hersam, M. C. (2015). "Hybrid, gate-tunable, van der Waals p-n heterojunctions from pentacene and MoS₂". *Nano letters*, Vol. 16, pp. 497-503.
- Jariwala, D., Marks, T. J., and Hersam, M. C. (2016). "Mixed-dimensional van der Waals heterostructures". *Nature materials*, Vol. 15, pp. 1617-1621.
- Jariwala, D., Marks, T. J., and Hersam, M. C. (2016). "Mixed-dimensional van der Waals heterostructures". *arXiv preprint arXiv:1608.00515*, Vol. 1608.00515.
- Jariwala, D., Marks, T. J., and Hersam, M. C. (2017). "Mixed-dimensional van der Waals heterostructures". *Nature materials*, Vol. 16, pp. 170-181.
- Jariwala, D., Sangwan, V. K., Wu, C.-C., Prabhumirashi, P. L., Geier, M. L., Marks, T. J., Lauhon, L. J., and Hersam, M. C. (2013). "Gate-tunable carbon nanotube-MoS₂ heterojunction pn diode". *Proceedings of the National Academy of Sciences*, Vol. 110, pp. 18076-18080.

- Jiang, L., Zhang, S., Kulinich, S. A., Song, X., Zhu, J., Wang, X., and Zeng, H. (2015). "Optimizing hybridization of 1T and 2H phases in MoS₂ monolayers to improve capacitances of supercapacitors". *Materials Research Letters*, Vol. 3, pp. 177-183.
- Kang, D. H., Kim, M. S., Shim, J., Jeon, J., Park, H. Y., Jung, W. S., Yu, H. Y., Pang, C. H., Lee, S., and Park, J. H. (2015). "High-performance transition metal dichalcogenide photodetectors enhanced by self-assembled monolayer doping". *Advanced Functional Materials*, Vol. 25, pp. 4219-4227.
- Kang, J., Cao, W., Xie, X., Sarkar, D., Liu, W., and Banerjee, K. (2014), "Graphene and beyond-graphene 2D crystals for next-generation green electronics. In "Micro-and Nanotechnology Sensors, Systems, and Applications VI", Vol. 9083, pp. 908305. International Society for Optics and Photonics.
- Kang, M.-A., Kim, S. J., Song, W., Chang, S.-j., Park, C.-Y., Myung, S., Lim, J., Lee, S. S., and An, K.-S. (2017). "Fabrication of flexible optoelectronic devices based on MoS₂/graphene hybrid patterns by a soft lithographic patterning method". *Carbon*, Vol. 116, pp. 167-173.
- Kim, S., Konar, A., Hwang, W.-S., Lee, J. H., Lee, J., Yang, J., Jung, C., Kim, H., Yoo, J.-B., and Choi, J.-Y. (2012). "High-mobility and low-power thin-film transistors based on multilayer MoS₂ crystals". *Nature communications*, Vol. 3, pp. ncomms2018.
- Kim, Y., Kwon, K. C., Kang, S., Kim, C., Kim, T. H., Hong, S.-P., Park, S. Y., Suh, J. M., Choi, M.-J., and Han, S. (2019). "Two-Dimensional NbS₂ Gas Sensors for Selective and Reversible NO₂ Detection at Room Temperature". *ACS sensors*, Vol. 4, pp. 2395-2402.
- King, S., Ronning, C., Davis, R., Benjamin, M., and Nemanich, R. (1998). "Dependence of (0001) GaN/AlN valence band discontinuity on growth temperature and surface reconstruction". *Journal of applied physics*, Vol. 84, pp. 2086-2090.
- Ko, K. Y., Song, J.-G., Kim, Y., Choi, T., Shin, S., Lee, C. W., Lee, K., Koo, J., Lee, H., and Kim, J. (2016). "Improvement of gas-sensing performance of large-area tungsten disulfide nanosheets by surface functionalization". *ACS nano*, Vol. 10, pp. 9287-9296.
- Koppens, F., Mueller, T., Avouris, P., Ferrari, A., Vitiello, M., and Polini, M. (2014). "Photodetectors based on graphene, other two-dimensional materials and hybrid systems". *Nature nanotechnology*, Vol. 9, pp. 780.
- Kraut, E., Grant, R., Waldrop, J., and Kowalczyk, S. (1980). "Precise determination of the valence-band edge in x-ray photoemission spectra: application to measurement of semiconductor interface potentials". *Physical Review Letters*, Vol. 44, pp. 1620.
- Krishnamoorthy, S., Lee, E. W., Lee, C. H., Zhang, Y., McCulloch, W. D., Johnson, J. M., Hwang, J., Wu, Y., and Rajan, S. (2016). "High current density 2D/3D MoS₂/GaN Esaki tunnel diodes". *Applied Physics Letters*, Vol. 109, pp. 183505.
- Kufer, D., Nikitskiy, I., Lasanta, T., Navickaite, G., Koppens, F. H., and Konstantatos, G. (2015). "Hybrid 2D-0D MoS₂-PbS quantum dot photodetectors". *Advanced materials*, Vol. 27, pp. 176-180.
- Kumar, A., Arafin, S., Amann, M. C., and Singh, R. (2013). "Temperature dependence of electrical characteristics of Pt/GaN Schottky diode fabricated by UHV e-beam evaporation". *Nanoscale research letters*, Vol. 8, pp. 481.
- Kumar, R., Goel, N., and Kumar, M. (2017). "UV-activated MoS₂ Based Fast and Reversible NO₂ Sensor at Room Temperature". *ACS sensors*, Vol. 2, pp. 1744-1752.
- Kumar, R., Goel, N., and Kumar, M. (2017). "UV-activated MoS₂ based fast and reversible NO₂ sensor at room temperature". *ACS sensors*, Vol. 2, pp. 1744-1752.
- Kuru, C., Choi, C., Kargar, A., Choi, D., Kim, Y. J., Liu, C. H., Yavuz, S., and Jin, S. (2015). "MoS₂ nanosheet-Pd nanoparticle composite for highly sensitive room temperature detection of hydrogen". *Advanced Science*, Vol. 2, pp. 1500004.
- Kuru, C., Choi, C., Kargar, A., Choi, D., Kim, Y. J., Liu, C. H., Yavuz, S., and Jin, S. (2015). "MoS₂ nanosheet-Pd nanoparticle composite for highly sensitive room temperature detection of hydrogen". *Advanced Science*, Vol. 2, pp. 1500004.
- Kwon, J., Hong, Y. K., Han, G., Omkaram, I., Choi, W., Kim, S., and Yoon, Y. (2015). "Giant photoamplification in indirect-bandgap multilayer MoS₂ phototransistors with local bottom-gate structures". *Advanced Materials*, Vol. 27, pp. 2224-2230.
- Kwon, J., Lee, J.-Y., Yu, Y.-J., Lee, C.-H., Cui, X., Hone, J., and Lee, G.-H. (2017). "Thickness-dependent Schottky barrier height of MoS₂ field-effect transistors". *Nanoscale*, Vol. 9, pp. 6151-6157.
- Larentis, S., Tolsma, J. R., Fallahzad, B., Dillen, D. C., Kim, K., MacDonald, A. H., and Tutuc, E. (2014). "Band offset and negative compressibility in graphene-MoS₂ heterostructures". *Nano letters*, Vol. 14, pp. 2039-2045.
- Late, D. J., Huang, Y.-K., Liu, B., Acharya, J., Shirodkar, S. N., Luo, J., Yan, A., Charles, D., Waghmare, U. V., and Dravid, V. P. (2013). "Sensing behavior of atomically thin-layered MoS₂ transistors". *ACS nano*, Vol. 7, pp. 4879-4891.

- Lee, B. H., Kang, L., Qi, W.-J., Nieh, R., Jeon, Y., Onishi, K., and Lee, J. C. (1999), "Ultrathin hafnium oxide with low leakage and excellent reliability for alternative gate dielectric application. In "International Electron Devices Meeting 1999. Technical Digest (Cat. No. 99CH36318)", pp. 133-136. IEEE.
- Lee, C., Wei, X., Kysar, J. W., and Hone, J. (2008). "Measurement of the elastic properties and intrinsic strength of monolayer graphene". *science*, Vol. 321, pp. 385-388.
- Lee, C., Yan, H., Brus, L. E., Heinz, T. F., Hone, J., and Ryu, S. (2010). "Anomalous lattice vibrations of single-and few-layer MoS₂". *ACS nano*, Vol. 4, pp. 2695-2700.
- Lee, K., Gatensby, R., McEvoy, N., Hallam, T., and Duesberg, G. S. (2013). "High-performance sensors based on molybdenum disulfide thin films". *Advanced materials*, Vol. 25, pp. 6699-6702.
- Lee, Y. H., Zhang, X. Q., Zhang, W., Chang, M. T., Lin, C. T., Chang, K. D., Yu, Y. C., Wang, J. T. W., Chang, C. S., and Li, L. J. (2012). "Synthesis of large-area MoS₂ atomic layers with chemical vapor deposition". *Advanced Materials*, Vol. 24, pp. 2320-2325.
- Lee, Y. K., Choi, H., Lee, H., Lee, C., Choi, J. S., Choi, C.-G., Hwang, E., and Park, J. Y. (2016). "Hot carrier multiplication on graphene/TiO₂ Schottky nanodiodes". *Scientific reports*, Vol. 6, pp. 27549.
- Lembke, D., Bertolazzi, S., and Kis, A. (2015). "Single-layer MoS₂ electronics". *Accounts of chemical research*, Vol. 48, pp. 100-110.
- Leong, W. S., Nai, C. T., and Thong, J. T. (2014). "What does annealing do to metal-graphene contacts?". *Nano letters*, Vol. 14, pp. 3840-3847.
- Li, F., Qi, J., Xu, M., Xiao, J., Xu, Y., Zhang, X., Liu, S., and Zhang, Y. (2017). "Layer dependence and light tuning surface potential of 2D MoS₂ on various substrates". *Small*, Vol. 13, pp. 1603103.
- Li, G., Suja, M., Chen, M., Bekyarova, E., Haddon, R. C., Liu, J., and Itkis, M. E. (2017). "Visible-blind UV photodetector based on single-walled carbon nanotube thin film/ZnO vertical heterostructures". *ACS applied materials & interfaces*, Vol. 9, pp. 37094-37104.
- Li, H., Huang, M., and Cao, G. (2016). "Markedly different adsorption behaviors of gas molecules on defective monolayer MoS₂: a first-principles study". *Physical Chemistry Chemical Physics*, Vol. 18, pp. 15110-15117.
- Li, H., Lu, G., Wang, Y., Yin, Z., Cong, C., He, Q., Wang, L., Ding, F., Yu, T., and Zhang, H. (2013). "Mechanical exfoliation and characterization of single-and few-layer nanosheets of WSe₂, TaS₂, and TaSe₂". *Small*, Vol. 9, pp. 1974-1981.
- Li, H., Wu, J., Yin, Z., and Zhang, H. (2014). "Preparation and applications of mechanically exfoliated single-layer and multilayer MoS₂ and WSe₂ nanosheets". *Accounts of chemical research*, Vol. 47, pp. 1067-1075.
- Li, H., Zhang, Q., Yap, C. C. R., Tay, B. K., Edwin, T. H. T., Olivier, A., and Baillargeat, D. (2012). "From bulk to monolayer MoS₂: evolution of Raman scattering". *Advanced Functional Materials*, Vol. 22, pp. 1385-1390.
- Li, J., Niu, L., Zheng, Z., and Yan, F. (2014). "Photosensitive graphene transistors". *Advanced Materials*, Vol. 26, pp. 5239-5273.
- Li, P., Yuan, K., Lin, D.-Y., Xu, X., Wang, Y., Wan, Y., Yu, H., Zhang, K., Ye, Y., and Dai, L. (2017). "Mixed-dimensional light-emitting diode based on a p-MoS₂ nanosheet and an n-CdSe nanowire". *Nanoscale*, Vol. 9, pp. 18175-18179.
- Li, P., Yuan, K., Lin, D.-Y., Xu, X., Wang, Y., Wan, Y., Yu, H., Zhang, K., Ye, Y., and Dai, L. (2017). "A mixed-dimensional light-emitting diode based on a p-MoS₂ nanosheet and an n-CdSe nanowire". *Nanoscale*, Vol. 9, pp. 18175-18179.
- Li, R., Zhu, P., Chen, J., Cao, J., Rentzepis, P. M., and Zhang, J. (2016). "Carrier emission of n-type gallium nitride illuminated by femtosecond laser pulses". *Journal of Applied Physics*, Vol. 120, pp. 233107.
- Li, S.-L., Komatsu, K., Nakaharai, S., Lin, Y.-F., Yamamoto, M., Duan, X., and Tsukagoshi, K. (2014). "Thickness scaling effect on interfacial barrier and electrical contact to two-dimensional MoS₂ layers". *ACS nano*, Vol. 8, pp. 12836-12842.
- Li, Y., Li, Z., Chi, C., Shan, H., Zheng, L., and Fang, Z. (2017). "Plasmonics of 2D Nanomaterials: Properties and Applications". *Advanced Science*, Vol. 4, pp. 1700001.
- Li, Y., Xu, C.-Y., Wang, J.-Y., and Zhen, L. (2014). "Photodiode-like behavior and excellent photoresponse of vertical Si/monolayer MoS₂ heterostructures". *Scientific reports*, Vol. 4, pp. 7186.
- Li, Y., Xu, C.-Y., Wang, J.-Y., and Zhen, L. (2014). "Photodiode-like behavior and excellent photoresponse of vertical Si/monolayer MoS₂ heterostructures". *Scientific reports*, Vol. 4, pp. 7186.
- Li, Z., Chen, J., Dhall, R., and Cronin, S. B. (2016). "Highly efficient, high speed vertical photodiodes based on few-layer MoS₂". *2D Materials*, Vol. 4, pp. 015004.
- Limmer, W., Ritter, W., Sauer, R., Mensching, B., Liu, C., and Rauschenbach, B. (1998). "Raman scattering in ion-implanted GaN". *Applied Physics Letters*, Vol. 72, pp. 2589-2591.

- Lin, J. D., Han, C., Wang, F., Wang, R., Xiang, D., Qin, S., Zhang, X.-A., Wang, L., Zhang, H., and Wee, A. T. S. (2014). "Electron-doping-enhanced trion formation in monolayer molybdenum disulfide functionalized with cesium carbonate". *ACS nano*, Vol. 8, pp. 5323-5329.
- Lin, Z., Liu, Y., Halim, U., Ding, M., Liu, Y., Wang, Y., Jia, C., Chen, P., Duan, X., and Wang, C. (2018). "Solution-processable 2D semiconductors for high-performance large-area electronics". *Nature*, Vol. 562, pp. 254-258.
- Liu, C.-H., Chang, Y.-C., Norris, T. B., and Zhong, Z. (2014). "Graphene photodetectors with ultra-broadband and high responsivity at room temperature". *Nature nanotechnology*, Vol. 9, pp. 273-278.
- Liu, H., Neal, A. T., Zhu, Z., Luo, Z., Xu, X., Tománek, D., and Ye, P. D. (2014). "Phosphorene: an unexplored 2D semiconductor with a high hole mobility". *ACS nano*, Vol. 8, pp. 4033-4041.
- Liu, J., Fei, P., Song, J., Wang, X., Lao, C., Tummala, R., and Wang, Z. L. (2008). "Carrier density and Schottky barrier on the performance of DC nanogenerator". *Nano letters*, Vol. 8, pp. 328-332.
- Liu, T., and Liu, Z. (2018). "2D MoS₂ Nanostructures for Biomedical Applications". *Advanced healthcare materials*, Vol. 7, pp. 1701158.
- Liu, W., Kang, J., Cao, W., Sarkar, D., Khatami, Y., Jena, D., and Banerjee, K. (2013). "High-performance few-layer-MoS₂ field-effect-transistor with record low contact-resistance. In "Electron Devices Meeting (IEDM), 2013 IEEE International", pp. 19.4. 1-19.4. 4. IEEE.
- Liu, X., Yang, X., Gao, G., Yang, Z., Liu, H., Li, Q., Lou, Z., Shen, G., Liao, L., and Pan, C. (2016). "Enhancing photoresponsivity of self-aligned MoS₂ field-effect transistors by Piezo-phototronic effect from GaN nanowires". *ACS nano*, Vol. 10, pp. 7451-7457.
- Liu, Y., Weiss, N. O., Duan, X., Cheng, H.-C., Huang, Y., and Duan, X. (2016). "Van der Waals heterostructures and devices". *Nature Reviews Materials*, Vol. 1, pp. 1-17.
- Lopez-Sanchez, O., Alarcon Llado, E., Koman, V., Fontcuberta i Morral, A., Radenovic, A., and Kis, A. (2014). "Light generation and harvesting in a van der Waals heterostructure". *Acs Nano*, Vol. 8, pp. 3042-3048.
- Lopez-Sanchez, O., Lembke, D., Kayci, M., Radenovic, A., and Kis, A. (2013). "Ultrasensitive photodetectors based on monolayer MoS₂". *Nature nanotechnology*, Vol. 8, pp. 497-501.
- Lopez-Sanchez, O., Lembke, D., Kayci, M., Radenovic, A., and Kis, A. (2013). "Ultrasensitive photodetectors based on monolayer MoS₂". *Nature nanotechnology*, Vol. 8, pp. 497-501.
- Lu, B., Matioli, E., and Palacios, T. (2012). "Low leakage normally-off tri-gate GaN MISFET. In "2012 24th International Symposium on Power Semiconductor Devices and ICs", pp. 33-36. Ieee.
- Lu, M.-Y., Lu, M.-P., You, S.-J., Chen, C.-W., and Wang, Y.-J. (2015). "Quantifying the barrier lowering of ZnO Schottky nanodevices under UV light". *Scientific reports*, Vol. 5, pp. 15123.
- Lu, M.-Y., Lu, M.-P., You, S.-J., Chen, C.-W., and Wang, Y.-J. (2015). "Quantifying the barrier lowering of ZnO Schottky nanodevices under UV light". *Scientific reports*, Vol. 5, pp. srep15123.
- Lu, N., Guo, H., Li, L., Dai, J., Wang, L., Mei, W.-N., Wu, X., and Zeng, X. C. (2014). "MoS₂/MX₂ heterobilayers: bandgap engineering via tensile strain or external electrical field". *Nanoscale*, Vol. 6, pp. 2879-2886.
- Ma, C., Shi, Y., Hu, W., Chiu, M. H., Liu, Z., Bera, A., Li, F., Wang, H., Li, L. J., and Wu, T. (2016). "Heterostructured WS₂/CH₃NH₃PbI₃ photoconductors with suppressed dark current and enhanced photodetectivity". *Advanced Materials*, Vol. 28, pp. 3683-3689.
- Mack, C. A. (2011). "Fifty years of Moore's law". *IEEE Transactions on semiconductor manufacturing*, Vol. 24, pp. 202-207.
- Magda, G. Z., Petó, J., Dobrik, G., Hwang, C., Biró, L. P., and Tapasztó, L. (2015). "Exfoliation of large-area transition metal chalcogenide single layers". *Scientific reports*, Vol. 5, pp. 14714.
- Majee, A. K., Foss, C. J., and Aksamija, Z. (2017). "Impact of mismatch angle on electronic transport across grain boundaries and interfaces in 2D materials". *Scientific reports*, Vol. 7, pp. 1-13.
- Mak, K. F., Ju, L., Wang, F., and Heinz, T. F. (2012). "Optical spectroscopy of graphene: From the far infrared to the ultraviolet". *Solid State Communications*, Vol. 152, pp. 1341-1349.
- Mak, K. F., Lee, C., Hone, J., Shan, J., and Heinz, T. F. (2010). "Atomically thin MoS₂: a new direct-gap semiconductor". *Physical review letters*, Vol. 105, pp. 136805.
- Mak, K. F., and Shan, J. (2016). "Photonics and optoelectronics of 2D semiconductor transition metal dichalcogenides". *Nature Photonics*, Vol. 10, pp. 216.
- Manzeli, S., Ovchinnikov, D., Pasquier, D., Yazyev, O. V., and Kis, A. (2017). "2D transition metal dichalcogenides". *Nature Reviews Materials*, Vol. 2, pp. 17033.
- Namgung, S., Shaver, J., Oh, S.-H., and Koester, S. J. (2016). "Multimodal photodiode and phototransistor device based on two-dimensional materials". *ACS nano*, Vol. 10, pp. 10500-10506.

- Nan, H., Wang, Z., Wang, W., Liang, Z., Lu, Y., Chen, Q., He, D., Tan, P., Miao, F., and Wang, X. (2014). "Strong photoluminescence enhancement of MoS₂ through defect engineering and oxygen bonding". *ACS nano*, Vol. 8, pp. 5738-5745.
- Newton, M. C., Firth, S., and Warburton, P. A. (2006). "ZnO tetrapod Schottky photodiodes". *Applied physics letters*, Vol. 89, pp. 072104.
- Nicolosi, V., Chhowalla, M., Kanatzidis, M. G., Strano, M. S., and Coleman, J. N. (2013). "Liquid exfoliation of layered materials". *Science*, Vol. 340, pp. 1226419.
- Nourbakhsh, A., Zubair, A., Sajjad, R. N., Tavakkoli KG, A., Chen, W., Fang, S., Ling, X., Kong, J., Dresselhaus, M. S., and Kaxiras, E. (2016). "MoS₂ field-effect transistor with sub-10 nm channel length". *Nano letters*, Vol. 16, pp. 7798-7806.
- Novoselov, K. S., and Geim, A. (2007). "The rise of graphene". *Nat. Mater*, Vol. 6, pp. 183-191.
- Novoselov, K. S., Geim, A. K., Morozov, S., Jiang, D., Katsnelson, M. I., Grigorieva, I., Dubonos, S., Firsov, and AA (2005). "Two-dimensional gas of massless Dirac fermions in graphene". *nature*, Vol. 438, pp. 197-200.
- Novoselov, K. S., Geim, A. K., Morozov, S. V., Jiang, D., Zhang, Y., Dubonos, S. V., Grigorieva, I. V., and Firsov, A. A. (2004). "Electric field effect in atomically thin carbon films". *science*, Vol. 306, pp. 666-669.
- Oliva, N., Casu, E. A., Yan, C., Krammer, A., Rosca, T., Magrez, A., Stolichnov, I., Schueler, A., Martin, O. J., and Ionescu, A. M. (2017). "Van der Waals MoS₂/VO₂ heterostructure junction with tunable rectifier behavior and efficient photoresponse". *Scientific reports*, Vol. 7, pp. 1-8.
- Ou, J. Z., Ge, W., Carey, B., Daeneke, T., Rotbart, A., Shan, W., Wang, Y., Fu, Z., Chrimes, A. F., and Wlodarski, W. (2015). "Physisorption-based charge transfer in two-dimensional SnS₂ for selective and reversible NO₂ gas sensing". *ACS nano*, Vol. 9, pp. 10313-10323.
- Özcelik, V. O., Azadani, J. G., Yang, C., Koester, S. J., and Low, T. (2016). "Band alignment of two-dimensional semiconductors for designing heterostructures with momentum space matching". *Physical Review B*, Vol. 94, pp. 035125.
- Pak, J., Jang, J., Cho, K., Kim, T.-Y., Kim, J.-K., Song, Y., Hong, W.-K., Min, M., Lee, H., and Lee, T. (2015). "Enhancement of photodetection characteristics of MoS₂ field effect transistors using surface treatment with copper phthalocyanine". *Nanoscale*, Vol. 7, pp. 18780-18788.
- Piazza, Z. A., Hu, H.-S., Li, W.-L., Zhao, Y.-F., Li, J., and Wang, L.-S. (2014). "Planar hexagonal B₃₆ as a potential basis for extended single-atom layer boron sheets". *Nature communications*, Vol. 5, pp. 1-6.
- Pospischil, A., and Mueller, T. (2016). "Optoelectronic Devices Based on Atomically Thin Transition Metal Dichalcogenides". *Applied Sciences*, Vol. 6, pp. 78.
- Qi, L., Wang, Y., Shen, L., and Wu, Y. (2016). "Chemisorption-induced n-doping of MoS₂ by oxygen". *Applied Physics Letters*, Vol. 108, pp. 063103.
- Qiao, S., Zhang, B., Feng, K., Cong, R., Yu, W., Fu, G., and Wang, S. (2017). "Large lateral photovoltage observed in MoS₂ thickness-modulated ITO/MoS₂/p-Si heterojunctions". *ACS applied materials & interfaces*, Vol. 9, pp. 18377-18387.
- Qin, Z., Ouyang, C., Zhang, J., Wan, L., Wang, S., Xie, C., and Zeng, D. (2017). "2D WS₂ nanosheets with TiO₂ quantum dots decoration for high-performance ammonia gas sensing at room temperature". *Sensors and Actuators B: Chemical*, Vol. 253, pp. 1034-1042.
- Qiu, H., Pan, L., Yao, Z., Li, J., Shi, Y., and Wang, X. (2012). "Electrical characterization of back-gated bilayer MoS₂ field-effect transistors and the effect of ambient on their performances". *Applied Physics Letters*, Vol. 100, pp. 123104.
- Radisavljevic, B., Radenovic, A., Brivio, J., Giacometti, i. V., and Kis, A. (2011). "Single-layer MoS₂ transistors". *Nature nanotechnology*, Vol. 6, pp. 147.
- Radisavljevic, B., Radenovic, A., Brivio, J., Giacometti, V., and Kis, A. (2011). "Single-layer MoS₂ transistors". *Nature nanotechnology*, Vol. 6, pp. 147.
- Ranwa, S., Kulriya, P. K., Sahu, V. K., Kukreja, L., and Kumar, M. (2014). "Defect-free ZnO nanorods for low temperature hydrogen sensor applications". *Applied Physics Letters*, Vol. 105, pp. 213103.
- Ranwa, S., Kumar Kulriya, P., Dixit, V., and Kumar, M. (2014). "Temperature dependent electrical transport studies of self-aligned ZnO nanorods/Si heterostructures deposited by sputtering". *Journal of Applied Physics*, Vol. 115, pp. 233706.
- Roul, B., Rajpalke, M. K., Bhat, T. N., Kumar, M., Sinha, N., Kalghatgi, A., and Krupanidhi, S. (2011). "Temperature dependent electrical transport behavior of InN/GaN heterostructure based Schottky diodes". *Journal of Applied Physics*, Vol. 109, pp. 044502-044502-5.

- Ruzmetov, D., Zhang, K., Stan, G., Kalanyan, B., Bhimanapati, G. R., Eichfeld, S. M., Burke, R. A., Shah, P. B., O'Regan, T. P., and Crowne, F. J. (2016). "Vertical 2D/3D semiconductor heterostructures based on epitaxial molybdenum disulfide and gallium nitride". *Acs Nano*, Vol. 10, pp. 3580-3588.
- Sakai, G., Matsunaga, N., Shimano, K., and Yamazoe, N. (2001). "Theory of gas-diffusion controlled sensitivity for thin film semiconductor gas sensor". *Sensors and Actuators B: Chemical*, Vol. 80, pp. 125-131.
- Schedin, F., Geim, A. K., Morozov, S. V., Hill, E., Blake, P., Katsnelson, M., and Novoselov, K. S. (2007). "Detection of individual gas molecules adsorbed on graphene". *Nature materials*, Vol. 6, pp. 652-655.
- Schulman, D. S., Arnold, A. J., Razavieh, A., Nasr, J., and Das, S. (2017). "The Prospect of Two-Dimensional Heterostructures: A Review of Recent Breakthroughs". *IEEE Nanotechnology Magazine*, Vol. 11, pp. 6-17.
- Sharma, R., Bisen, D., Shukla, U., and Sharma, B. (2012). "X-ray diffraction: a powerful method of characterizing nanomaterials". *Recent Research in Science and Technology*, Vol. 4.
- Shishir, R., and Ferry, D. (2009). "Intrinsic mobility in graphene". *Journal of Physics: Condensed Matter*, Vol. 21, pp. 232204.
- Singh, A., Uddin, M. A., Sudarshan, T., and Koley, G. (2014). "Tunable Reverse-Biased Graphene/Silicon Heterojunction Schottky Diode Sensor". *Small*, Vol. 10, pp. 1555-1565.
- Son, Y., Wang, Q. H., Paulson, J. A., Shih, C.-J., Rajan, A. G., Tvrđy, K., Kim, S., Alfeeli, B., Braatz, R. D., and Strano, M. S. (2015). "Layer number dependence of MoS₂ photoconductivity using photocurrent spectral atomic force microscopic imaging". *ACS nano*, Vol. 9, pp. 2843-2855.
- Splendiani, A., Sun, L., Zhang, Y., Li, T., Kim, J., Chim, C.-Y., Galli, G., and Wang, F. (2010). "Emerging photoluminescence in monolayer MoS₂". *Nano letters*, Vol. 10, pp. 1271-1275.
- Srisonphan, S. (2016). "Hybrid graphene-Si-based nanoscale vacuum field effect phototransistors". *ACS Photonics*, Vol. 3, pp. 1799-1808.
- Sun, X., Li, D., Li, Z., Song, H., Jiang, H., Chen, Y., Miao, G., and Zhang, Z. (2015). "High spectral response of self-driven GaN-based detectors by controlling the contact barrier height". *Scientific Reports*, Vol. 5, pp. 16819.
- Sweet, C., Pramanik, A., Jones, S., and Ray, P. C. (2017). "Two-Photon Fluorescent Molybdenum Disulfide Dots for Targeted Prostate Cancer Imaging in the Biological II Window". *ACS Omega*, Vol. 2, pp. 1826-1835.
- Sze, S. M., and Ng, K. K. (2006), *Physics of semiconductor devices*. Vol. John Wiley & sons.
- Tangi, M., Mishra, P., Li, M.-Y., Shakfa, M. K., Anjum, D. H., Hedhili, M. N., Ng, T. K., Li, L.-J., and Ooi, B. S. (2017). "Type-I band alignment at MoS₂/In_{0.15}Al_{0.85}N lattice matched heterojunction and realization of MoS₂ quantum well". *Applied Physics Letters*, Vol. 111, pp. 092104.
- Tangi, M., Mishra, P., Tseng, C.-C., Ng, T. K., Hedhili, M. N., Anjum, D. H., Alias, M. S., Wei, N., Li, L.-J., and Ooi, B. S. (2017). "Band alignment at GaN/single-layer WSe₂ interface". *ACS applied materials & interfaces*, Vol. 9, pp. 9110-9117.
- Thakar, K., and Lodha, S. (2020). "Optoelectronic and photonic devices based on transition metal dichalcogenides". *Materials Research Express*, Vol. 7, pp. 014002.
- Tielrooij, K. J., Song, J. C. W., Jensen, S. A., Centeno, A., Pesquera, A., Zurutuza Elorza, A., Bonn, M., Levitov, L. S., and Koppens, F. H. L. (2013). "Photoexcitation cascade and multiple hot-carrier generation in graphene". *Nat Phys*, Vol. 9, pp. 248-252.
- Tsai, D.-S., Liu, K.-K., Lien, D.-H., Tsai, M.-L., Kang, C.-F., Lin, C.-A., Li, L.-J., and He, J.-H. (2013). "Few-layer MoS₂ with high broadband photogain and fast optical switching for use in harsh environments". *Acs Nano*, Vol. 7, pp. 3905-3911.
- Tsai, M.-L., Su, S.-H., Chang, J.-K., Tsai, D.-S., Chen, C.-H., Wu, C.-I., Li, L.-J., Chen, L.-J., and He, J.-H. (2014). "Monolayer MoS₂ heterojunction solar cells". *ACS nano*, Vol. 8, pp. 8317-8322.
- Tung, R., Ng, K., Gibson, J., and Levi, A. (1986). "Schottky-barrier heights of single-crystal NiSi₂ on Si (111): The effect of a surface p-n junction". *Physical Review B*, Vol. 33, pp. 7077.
- Um, D.-S., Lee, Y., Lim, S., Park, S., Lee, H., and Ko, H. (2016). "High-Performance MoS₂/CuO Nanosheet-on-One-Dimensional Heterojunction Photodetectors". *ACS applied materials & interfaces*, Vol. 8, pp. 33955-33962.
- Van Vliet, C. M. (1995). "Responsivity and noise in illustrative solid-state chemical sensors". *Sensors and Actuators B: Chemical*, Vol. 24, pp. 6-16.
- Voiry, D., Mohite, A., and Chhowalla, M. (2015). "Phase engineering of transition metal dichalcogenides". *Chemical Society Reviews*, Vol. 44, pp. 2702-2712.

- Wang, J., Xu, F., Zhang, X., An, W., Li, X.-Z., Song, J., Ge, W., Tian, G., Lu, J., and Wang, X. (2014). "Evidence of Type-II Band Alignment in III-nitride Semiconductors: Experimental and theoretical investigation for In_{0.17}Al_{0.83}N/GaN heterostructures". *Scientific reports*, Vol. 4, pp. 6521.
- Wang, L., Jie, J., Shao, Z., Zhang, Q., Zhang, X., Wang, Y., Sun, Z., and Lee, S. T. (2015). "MoS₂/Si Heterojunction with Vertically Standing Layered Structure for Ultrafast, High-Detectivity, Self-Driven Visible-Near Infrared Photodetectors". *Advanced Functional Materials*, Vol. 25, pp. 2910-2919.
- Wang, Q. H., Kalantar-Zadeh, K., Kis, A., Coleman, J. N., and Strano, M. S. (2012). "Electronics and optoelectronics of two-dimensional transition metal dichalcogenides". *Nature nanotechnology*, Vol. 7, pp. 699.
- Wang, Q. H., Kalantar-Zadeh, K., Kis, A., Coleman, J. N., and Strano, M. S. (2012). "Electronics and optoelectronics of two-dimensional transition metal dichalcogenides". *Nat Nano*, Vol. 7, pp. 699-712.
- Wang, Y., Wang, B., Zhang, Q., Huang, R., Gao, B., Kong, F., and Wang, X. (2014). "TUNING STRUCTURAL AND ELECTRONIC PROPERTIES OF MoS₂ NANOTUBES BY TRANSVERSE ELECTRIC FIELD". *Chalcogenide Letters*, Vol. 11, pp. 493-502.
- Wang, Z., He, X., Zhang, X. X., and Alshareef, H. N. (2016). "Hybrid van der Waals p-n Heterojunctions based on SnO and 2D MoS₂". *Advanced Materials*, Vol. 28, pp. 9133-9141.
- Wei, T.-Y., Yeh, P.-H., Lu, S.-Y., and Wang, Z. L. (2009). "Gigantic enhancement in sensitivity using Schottky contacted nanowire nanosensor". *Journal of the American Chemical Society*, Vol. 131, pp. 17690-17695.
- Weng, W.-Y., Hsueh, T.-J., Chang, S.-J., Wang, S.-B., Hsueh, H.-T., and Huang, G.-J. (2011). "A high-responsivity GaN nanowire UV photodetector". *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 17, pp. 996-1001.
- Winzer, T., Knorr, A., and Malic, E. (2010). "Carrier multiplication in graphene". *Nano letters*, Vol. 10, pp. 4839-4843.
- Wong, S. L., Liu, H., and Chi, D. (2016). "Recent progress in chemical vapor deposition growth of two-dimensional transition metal dichalcogenides". *Progress in Crystal Growth and Characterization of Materials*, Vol. 62, pp. 9-28.
- Wu, D., Lou, Z., Wang, Y., Xu, T., Shi, Z., Xu, J., Tian, Y., and Li, X. (2017). "Construction of MoS₂/Si nanowire array heterojunction for ultrahigh-sensitivity gas sensor". *Nanotechnology*, Vol. 28, pp. 435503.
- Xia, F., Farmer, D. B., Lin, Y.-m., and Avouris, P. (2010). "Graphene field-effect transistors with high on/off current ratio and large transport band gap at room temperature". *Nano letters*, Vol. 10, pp. 715-718.
- Xia, F., Wang, H., Xiao, D., Dubey, M., and Ramasubramaniam, A. (2014). "Two-dimensional material nanophotonics". *Nature Photonics*, Vol. 8, pp. 899.
- Xie, C., Mak, C., Tao, X., and Yan, F. (2017). "Photodetectors based on two-dimensional layered materials beyond graphene". *Advanced Functional Materials*, Vol. 27, pp. 1603886.
- Xu, B., Chakraborty, H., Yadav, V. K., Zhang, Z., Klein, M. L., and Ren, S. (2017). "Tunable two-dimensional interfacial coupling in molecular heterostructures". *Nature communications*, Vol. 8, pp. 312.
- Xu, H., Wu, J., Feng, Q., Mao, N., Wang, C., and Zhang, J. (2014). "High responsivity and gate tunable graphene-MoS₂ hybrid phototransistor". *Small*, Vol. 10, pp. 2300-2306.
- Xue, F., Chen, L., Chen, J., Liu, J., Wang, L., Chen, M., Pang, Y., Yang, X., Gao, G., and Zhai, J. (2016). "p-Type MoS₂ and n-Type ZnO diode and its performance enhancement by the piezophototronic effect". *Advanced Materials*, Vol. 28, pp. 3391-3398.
- Xue, F., Yang, L., Chen, M., Chen, J., Yang, X., Wang, L., Chen, L., Pan, C., and Wang, Z. L. (2017). "Enhanced photoresponsivity of the MoS₂-GaN heterojunction diode via the piezo-phototronic effect". *NPG Asia Materials*, Vol. 9, pp. e418-e418.
- Xue, F., Yang, L., Chen, M., Chen, J., Yang, X., Wang, L., Chen, L., Pan, C., and Wang, Z. L. (2017). "Enhanced photoresponsivity of the MoS₂-GaN heterojunction diode via the piezo-phototronic effect". *NPG Asia Materials*, Vol. 9, pp. e418.
- Yan, H., Song, P., Zhang, S., Yang, Z., and Wang, Q. (2015). "Dispersed SnO₂ nanoparticles on MoS₂ nanosheets for superior gas-sensing performances to ethanol". *RSC Advances*, Vol. 5, pp. 79593-79599.
- Yang, F., Cong, H., Yu, K., Zhou, L., Wang, N., Liu, Z., Li, C., Wang, Q., and Cheng, B. (2017). "Ultrathin broadband Germanium-graphene hybrid photodetector with high performance". *ACS applied materials & interfaces*, Vol. 9, pp. 13422-13429.

- Yeh, C.-H., Liang, Z.-Y., Lin, Y.-C., Wu, T.-L., Fan, T., Chu, Y.-C., Ma, C.-H., Liu, Y.-C., Chu, Y.-H., and Suenaga, K. (2017). "Scalable van der Waals Heterojunctions for High-Performance Photodetectors". *ACS applied materials & interfaces*, Vol. 9, pp. 36181-36188.
- Yi, M., and Shen, Z. (2015). "A review on mechanical exfoliation for the scalable production of graphene". *Journal of Materials Chemistry A*, Vol. 3, pp. 11700-11715.
- Yim, C., O'Brien, M., McEvoy, N., Winters, S., Mirza, I., Lunney, J. G., and Duesberg, G. S. (2014). "Investigation of the optical properties of MoS₂ thin films using spectroscopic ellipsometry". *Applied Physics Letters*, Vol. 104, pp. 103114.
- Yoon, Y., Ganapathi, K., and Salahuddin, S. (2011). "How good can monolayer MoS₂ transistors be?". *Nano letters*, Vol. 11, pp. 3768-3773.
- Yu, W. J., Liu, Y., Zhou, H., Yin, A., Li, Z., Huang, Y., and Duan, X. (2013). "Highly efficient gate-tunable photocurrent generation in vertical heterostructures of layered materials". *Nature nanotechnology*, Vol. 8, pp. 952.
- Yue, Q., Shao, Z., Chang, S., and Li, J. (2013). "Adsorption of gas molecules on monolayer MoS₂ and effect of applied electric field". *Nanoscale research letters*, Vol. 8, pp. 425.
- Zhang, J., and Harrell, W. R. (2003). "Analysis of the I-V characteristics of Al/4H-SiC Schottky diodes". *Journal of Vacuum Science & Technology B: Microelectronics and Nanometer Structures Processing, Measurement, and Phenomena*, Vol. 21, pp. 872-878.
- Zhang, K., Feng, Y., Wang, F., Yang, Z., and Wang, J. (2017). "Two dimensional hexagonal boron nitride (2D-hBN): synthesis, properties and applications". *Journal of Materials Chemistry C*, Vol. 5, pp. 11992-12022.
- Zhang, W., Chiu, M.-H., Chen, C.-H., Chen, W., Li, L.-J., and Wee, A. T. S. (2014). "Role of Metal Contacts in High-Performance Phototransistors Based on WSe₂ Monolayers". *ACS Nano*, Vol. 8, pp. 8653-8661.
- Zhang, W., Chuu, C.-P., Huang, J.-K., Chen, C.-H., Tsai, M.-L., Chang, Y.-H., Liang, C.-T., Chen, Y.-Z., He, Y.-L. C. J.-H., and Chou, M.-Y. (2014). "Ultrahigh-gain photodetectors based on atomically thin graphene-MoS₂ heterostructures". *Scientific reports*, Vol. 4.
- Zhang, X., Hou, L., Ciesielski, A., and Samori, P. (2016). "2D materials beyond graphene for high-performance energy storage applications". *Advanced Energy Materials*, Vol. 6, pp. 1600671.
- Zhang, X., Rajaraman, B. R., Liu, H., and Ramakrishna, S. (2014). "Graphene's potential in materials science and engineering". *RSC Advances*, Vol. 4, pp. 28987-29011.
- Zhang, Y., Wang, S., Yu, H., Zhang, H., Chen, Y., Mei, L., Di Lieto, A., Tonelli, M., and Wang, J. (2015). "Atomic-layer molybdenum sulfide optical modulator for visible coherent light". Vol. 5, pp. 11342.
- Zhong, X., Zhou, W., Peng, Y., Zhou, Y., Zhou, F., Yin, Y., and Tang, D. (2015). "Multi-layered MoS₂ phototransistors as high performance photovoltaic cells and self-powered photodetectors". *RSC Advances*, Vol. 5, pp. 45239-45248.
- Zhou, H., Mei, J., Xue, M., Song, Z., and Wang, H. (2017). "High-Stability, Self-Powered Perovskite Photodetector Based on a CH₃NH₃PbI₃/GaN Heterojunction with C₆₀ as an Electron Transport Layer". *The Journal of Physical Chemistry C*, Vol. 121, pp. 21541-21545.
- Zhu, H., Shan, C., Yao, B., Li, B., Zhang, J., Zhao, D., Shen, D., and Fan, X. (2008). "High spectrum selectivity ultraviolet photodetector fabricated from an n-ZnO/p-GaN heterojunction". *The Journal of Physical Chemistry C*, Vol. 112, pp. 20546-20548.
- Zhuo, R., Wang, Y., Wu, D., Lou, Z., Shi, Z., Xu, T., Xu, J., Tian, Y., and Li, X. (2018). "High-performance self-powered deep ultraviolet photodetector based on MoS₂/GaN p-n heterojunction". *Journal of Materials Chemistry C*, Vol. 6, pp. 299-303.