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Research Interest

- Novel solid-state devices for ubiquitous electronics (computing, memory, sensors, energy harvesting, quantum, multiferroic) through innovative material techniques

Employment

2018 – present	Postdoctoral Associate, **Massachusetts Institute of Technology**
2012 – 2017	Senior Engineer, **Samsung Electronics**
	(in lieu of mandatory military service)
2008 – 2012	Research Assistant, **University of Michigan-Ann Arbor**

Education

2008 – 2012	Ph.D. in Electrical Engineering, **University of Michigan-Ann Arbor**
2005 – 2008	B.S. in Electrical Engineering, **University of Texas-Austin**

■ Peer-reviewed publications (Google scholar profile)

20. **Hyun S. Kum***, Hyungwoo Lee*, Sungkyu Kim*, Shane Lindemann*, Wei Kong, Kuan Qiao, Peng Chen, Julian Irwin, June Hyuk Lee, Saien Xie, Shruti Subramanian, Jaewoo Shim, Sang-Hoon Bae, Chanyeol Choi, Luigi Ranno, Seungju Seo, Sangho Lee, Jackson Bauer, Huashan Li, Kyusang Lee, Joshua A. Robinson, Caroline A. Ross, Darrell G. Schlom, Mark S. Rzchowski, Chang-Beom Eom, and Jeehwan Kim, "Heterogeneous integration of freestanding epitaxial complex-oxide membranes," ***Nature*** **578**, 75-81 (2020).

19. Sang-Hoon Bae*, Kuangye Lu*, Yimo Han*, Sungkyu Kim*, Kuan Qiao, Chanyeol Choi, Hyunseok Kim, **Hyun S. Kum**, Peng Chen, Wei Kong, Beom-Seok Kang, Jaekang Song, Minho Joo, Jinhee Park, Yongmin Baek, Kyusang Lee, Prof. David Muller, Yifan Nie, and Jeehwan Kim, "Graphene allows spontaneous relaxation toward dislocation-free heteroepitaxy," ***Nature Nanotechnology*** **15**, 272-276 (2020).

18. **Hyun Kum**, Doeon Lee, Wei Kong, Yongmo Park, Yunjo Kim, Yongmin Baek, Sang-Hoon Bae, Kyusang Lee, and Jeehwan Kim, "Epitaxial growth and layer-transfer techniques for heterogeneous integration of materials for electronic and photonic devices", ***Nature Electronics*** **2**, 439-450 (2019).

17. Wei Kong, **Hyun Kum**, Sang-Hoon Bae, Lingping Kong, Kejia Wang, Chansoo Kim, Yuan Meng, "Path towards graphene commercialization from lab to market", ***Nature Nanotechnology***, **14**, 927-938 (2019).

16. Sang-Hoon Bae, **Hyun Kum**, Wei Kong, Yunjo Kim, Chanyeol Choi, Byunghun Lee, Peng Lin, Yongmo Park, and Jeehwan Kim, "Integration of bulk materials with two-dimensional materials for physical coupling and their applications", ***Nature Materials*** **18**, 550-560 (2019).

15. Jaewoo Shim*, Sang-Hoon Bae*, Wei Kong*, Doyoon Lee*, Kuan Qiao, Daniel Nezich, Yong Ju Park, Ruike Zhao, Suresh Sundaram, Xin Li, Hanwool Yeon, Chanyeol Choi, **Hyun Kum**, Ruoyu Yue, Guanyu Zhou, Yunbo Ou, Kyusang Lee, Jagadeesh Moodera, Xuanhe Zhao, Jong-Hyun Ahn, Christopher Hinkle, Abdallah Ougazzaden, and Jeehwan Kim, "Controlled crack propagation for atomic precision handling of wafer-scale two-dimensional materials", ***Science*** **362**, 665-670 (2018).

14. Mohadeseh A Baboli, Michael A Slocum, **Hyun Kum**, Thomas S Wilhelm, Stephen J Polly, Seth M Hubbard, Parsian K Mohseni, "Improving pseudo-van der Waals epitaxy of self-assembled InAs nanowires on graphene via MOCVD parameter space mapping", ***CrystEngComm***, **21**, 602-615 (2019).

13. **Hyun Kum**, Yushuai Dai, Taketo Aihara, Michael A. Slocum, Takeshi Tayagaki, Anastasiia Fedorenko, Stephen J. Polly, Zachary Bittner, Takeyoshi Sugaya, Seth M. Hubbard, "Two-step photon absorption in InP/InGaP quantum dot solar cells," ***Appl. Phys. Lett.*** **113**, 043902 (2018).

12. Sudersena Rao Tatavarti, Zachary S Bittner, A Wibowo, Michael A Slocum, George Nelson, **Hyun Kum**, S Phillip Ahrenkiel, Seth M Hubbard, "Epitaxial Lift-off (ELO) of InGaP/GaAs/InGaAs solar cells with quantum dots in GaAs middle sub-cell", ***Sol. Energy Mater Sol. Cells*** **185**, 153 (2018).

11. Jaewoo Shim, Dong-Ho Kang, Yunjo Kim, **Hyun Kum**, Wei Kong, Sang-Hoon Bae, Ibraheem Almansouri, Kyusang Lee, Jin-Hong Park, Jeehwan Kim, "Recent progress in Van der Waals (vdW) heterojunction-based electronic and optoelectronic devices", ***Carbon*** **133**, 78 (2018).

10. **Hyun Kum**, Han-Kyu Seong, Wantae Lim, Daemyung Chun, Geonwook Yoo, Yong-il Kim, Yongsoo Park, "Wafer-scale Thermodynamically Stable GaN Nanorods via Two-Step Self-Limiting Epitaxy for Optoelectronic Applications," ***Sci. Rep.***, **7**, 40893 (2017).

9. Wantae Lim, **Hyun Kum**, Young-Jin Choi, Sung-Hyun Sim, Ji-Hye Yeon, Jung-Sub Kim, Han-Kyu Seong, Nam-Goo Cha, Yong-Il Kim, Young-Soo Park, Geonwook Yoo, Stephen J Pearton, "SiO2 nanohole arrays with high aspect ratio for InGaN/GaN nanorod-based phosphor-free white light-emitting-diodes," ***J. Vac. Sci. Technol. B*** **34**, 042204 (2016).

8. **Hyun Kum**, Mihyun Kim, Dong-gun Lee, Yongjo Tak, Jongsun Maeng, Joosung Kim, Gilho Gu, Joong Jung Kim, Yongil Kim, Jun-Youn Kim, Youngsoo Park, "Dependence of reverse bias leakage on depletion width and v-pit size in InGaN/GaN light-emitting diodes grown on silicon," ***J. Vac. Sci. Technol. B*** **33**, 060602 (2015).

7. Shafat Jahangir, Fatih Dogan, **Hyun Kum**, Aurelien Manchon, and Pallab Bhattacharya, "Spin diffusion in bulk GaN measured with MnAs spin injector," ***Phys. Rev. B*** **86**, 035315 (2012).

6. **Hyun Kum**, Junseok Heo, Shafat Jahangir, Animesh Banerjee, Wei Guo, and Pallab Bhattacharya, "Room temperature single GaN nanowire spin valves with FeCo/MgO tunnel contacts," ***Appl. Phys. Lett.*** **100**, 182407 (2012).

5. **Hyun Kum**, Shafat Jahangir, Debashish Basu, Dipankar Saha, and Pallab Bhattacharya, "Gate control and amplification of magnetoresistance in a three-terminal device," ***Appl. Phys. Lett.*** **99**, 152503 (2011).

4. Abu Zainuddin, **Hyun Kum**, Debashish Basu, Srikant Srinivasan, Lutfe Siddiqui, Pallab Bhattacharya, and Supriyo Datta, "Magnetoresistance of lateral semiconductor spin valves," ***J. Appl. Phys.*** **108**, 123913 (2010).

3. Debashish Basu, **Hyun Kum**, Pallab Bhattacharya, and Dipankar Saha, "Characteristics of a high temperature vertical spin valve," ***Appl. Phys. Lett.*** **97**, 2505 (2010).

2. **Hyun Kum**, Debahsish Basu, Pallab Bhattacharya, and Wei Guo, "Electric field control of magnetoresistance in a lateral InAs quantum well spin valve," ***Appl. Phys. Lett.*** **95**, 2503 (2009).

1. Debashish Basu, Pallab Bhattacharya, Wei Guo, and **Hyun Kum**, "Epitaxial growth and characterization of MnAs on InP and $In_{0.53}Ga_{0.47}As$," ***J. Phys. D*** **42**, 092001 (2009).

* = equal contribution

■ Preprint manuscripts

1. **Hyun Kum**, Namsung Kim, Young Hwan Park, Joosung Kim, Daemyung Chun, Jongsun Maeng, Yuseung Kim, Jun-Youn Kim, Dong-Pyo Han, Dong-Soo Shin, Jong-In Shim, Young Soo Park, "Enhanced high-temperature performance of GaN light-emitting diodes grown on silicon substrates", arXiv:1603.02338 (2016).

■ Conference presentations

14. Geoffrey K Bradshaw, Mitsul Kacharia, Emily Kessler-Lewis, David Wilt, Stephen J Polly, Colin J Mann, **Hyunseong Kum**, Seth M Hubbard, "Investigation of Radiative Coupling from InGaAsP Quantum Wells for Improved End-of-Life (EOL) Efficiency in Multijunction Solar Cells", 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC) Chicago, IL, June 2019.

13. Hyuna Jung, **Hyun Kum**, Jinyoung Hwang, "Band Alignment Transition from Type I to Type II of InP/$In_{0.48}Ga_{0.52}P$ quantum Dots," TENCON Jeju, Korea, October 2018.

12. Ruizhe Yao, Bowen Zheng, **Hyun Kum**, Yunjo Kim, Sanghoon Bae, Jeehwan Kim, Hualiang Zhang, and Wei Guo, "Graphene/III-V Hybrid Diode Optical Modulator" CLEO San Jose, CA, May 2018.

11. Seth M. Hubbard, **Hyun Kum**, Yushuai Dai, Zachary Bittner, "Application of InP quantum dots toward high-temperature intermediate-band solar-cell operation" SPIE Photonics West, San Francisco CA, January 2018.

10. Mohadeseh Asadolahi-Baboli, Michael A. Slocum, Alessandro Giussani, Thomas S. Wilhelm, **Hyun Kum**, Seth M. Hubbard, and Parsian Katal Mohseni, "Parameter Space Mapping of InAsP Nanowire Arrays on Graphene, h-BN and MoS2 Monolayers—Toward Selective Area van der Waals Epitaxy" 59th Electronic Materials Conference, South Bend IN, June 2017.

9. **Hyun Kum**, Michael Slocum, Yushuai Dai, Zachary Bittner, Seth Hubbard, "Type-II InP Quantum Dots Grown by MOCVD for Intermediate Band Solar Cell Applications" 44th IEEE Photovoltaics Conference, Washington DC, June 2017.

8. Zachary S. Bittner, **Hyun Kum**, Michael A. Slocum, George T. Nelson, Rao Tatavarti, Andree Wibowo, Seth M. Hubbard, "Integration of Quantum Dots and Quantum Wells into InGaAs Metamorphic Subcell for Radiation Hard 3-J ELO IMM Photovoltaics" 44th IEEE Photovoltaics Conference, Washington DC, June 2017.

7. Yushuai Dai, Brittany L Smith, Micheal A Slocum, Zachary S Bittner, **Hyun Kum**, Seth M Hubbard, "Temperature and voltage bias dependent two step photon absorption in InAs/GaAs/Al0.3GaAs quantum dot in a well solar cells" 44th IEEE Photovoltaics Conference, Washington DC, June 2017.

6. Yushuai Dai, **Hyun Kum**, Micheal A Slocum, Seth M Hubbard, "Over 30% efficiency single-junction photovoltaic devices under low intensity light illumination" 44th IEEE Photovoltaics Conference, Washington DC, June 2017.

5. Mohadeseh Asadolahi-Baboli, Michael A. Slocum, Alessandro Giussani, Thomas S. Wilhelm, **Hyun Kum**, Seth M. Hubbard, and Parsian Katal Mohseni, "Selective-area van der Walls epitaxy of InAsP nanowires on two-dimensional nanosheets: III-V integration on graphene, h-HN, and MoS2" 10th Nanowire week, Lund Sweden, May 2017.

4. Seth Hubbard, Michael Slocum, Zac Bittner, **Hyun Kum**, Rao Tatavarti, "Bandgap Engineering and Radiation Effects in Nanostructured Multijunction Solar Cells." International Semiconductor Device Research Symposium, Bethesda MD, December 2016.

3. **Hyun Kum**, Shafat Jahangir, Junseok Heo, Animesh Banerjee, Wei Guo, and Pallab Bhattacharya, "Single GaN nanowire spin valves with FeCo/MgO tunnel contacts," Electronic Materials Conference, University Park, State College PA, June 2012.

2. Debashish Basu, **Hyun Kum**, Wei Guo, and Pallab Bhattacharya, "Properties of MnAs/GaMnAs/MnAs magnetic multilayers and their application to high temperature vertical spin valves," Electronic Materials Conference, University of Notre Dame, Indiana, 2010.

1. **Hyun Kum**, Debashish Basu, Pallab Bhattacharya, and Wei Guo, "Electrical control of Magnetoresistance in a InP-based lateral spin valve with a two-dimensional electron gas (2-DEG) channel," APS March Meeting, Portland OR, March 2010.

■ Invited talks

2. "Artificial complex-oxide membrane heterostructures", MRS Spring Meeting, Phoenix, Arizona (April 2020). (cancelled due to COVID-19)

1. "Heterointegration of epitaxial complex-oxide membranes", **Kyung Hee University**, South Korea (February 2019).

■ Invited articles

1. **Hyun Kum**, Joosung Kim, Yongjo Tak, Jongsun Maeng, Jun-Youn Kim and Youngsoo Park, "Increasing the effectiveness of the GaN-on-Si LED", *Compound Semiconductor Magazine* Vol. 22 Issue 2, March 2016: 24-29.

■ Patents

5. Jun Youn Kim, **Hyun Seong Kum**, Young Hwan Park. Display panels and multivision apparatuses (Patent Granted July 2, 2019, US Patent 10,338,876): Display technology combining LED pixels and conventional LCD/OLED technology for bezel-less integration of multi-display units

4. Jae Hyeok Heo, Jin Sub Lee, Young Jin Choi, **Hyun Seong Kum**, Ji Hye Yeon, Dae Myung Chun, Jung Sub Kim, Han Kyu Seong. Method of manufacturing nano-structure semiconductor light emitting diode (Patent granted December 12, 2017, US Patent 9,842,960): Optimum design of nanorods LEDs for uniform active region in a core-shell nanorod LED.

3. **Hyun Seong Kum**, Dae Myung Chun, Ji Hye Yeon, Han Kyu Seong, Jin Sub Lee, Young Jin Choi, Jae Hyeok Heo. Semiconductor light emitting device and manufacturing method of the same (Patent granted March 14, 2017, US Patent 9,595,637): Method of growing uniform GaN nanorods with uniform hexagonal pyramid tips.

2. Dae Myung Chun, Ji Hye yeon, Jae Hyeok Heo, **Hyun Seong Kum**, Han Kyu Seong, Young Jin Choi. Semiconductor light emitting device and manufacturing method thereof (Patent granted January 24, 2017, US Patent 9,553,235): Method of epitaxially growing uniform core-shell GaN nanorods.

1. Nam Goo Cha, **Hyun Seong Kum**, Ju Bin Seo, Dong Hoon Lee. Nanostructure semiconductor light emitting device (Patent granted October 4, 2016, US Patent 9,461,205): Method of reducing leakage current and improve light output by etching the top portion of nanorod LEDs.

■ Media coverages

1. The paper "Heterogeneous integration of freestanding epitaxial complex-oxide membranes" (published in Nature) was covered by:

MIT News: Engineers mix and match materials to make new stretchy electronics (http://news.mit.edu/2020/flexible-electronics-stacks-chips-0205)

CNET: Truly flexible electronics are coming for your skin, eyes, and body (https://youtu.be/QSdAknrrFmA)

University of Wisconsin-Madison News: Crystal-stacking process can produce new materials for high-tech devices (https://news.wisc.edu/crystal-stacking-process-can-produce-new-materials-for-high-tech-devices/)

Nature News & Views: A platform for making and transferring oxide films (https://doi.org/10.1038/d41586-020-00206-1)