

SHIN HUM CHO

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Keimyung University, 1095 Dalgubeoldaero

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EDUCATION

B.S.

KAIST (Korea Advanced Institute of Science and Technology)

Chemical & Biomolecular Engineering (2009 ~ 2015)

Chemistry (2009 ~ 2015)

Graduation with Honors: Cum Laude

Ph.D.

University of Texas at Austin

McKetta Department of Chemical Engineering (2015 ~ 2020)

Fulbright Scholarship

Advisor: Dr. Delia J. Milliron

RESEARCH POSITIONS

• **Keimyung University, SHIN' Research Group** (shinhumcho.wixsite.com/shingroup)

Assistant Professor · Daegu, South Korea

Sep 2021 – Present

- *Doped Semiconductor Nanomaterials*
- Deploying semiconductor industry material AI automation control strategies in nanocrystals, n-type doping free electron control for infrared plasmonics. Hypersonic materials application.
- Scale-up chemical engineering batch synthesis process in doped metal oxide nanocrystals.
- Investigation in fundamental plasmonic sciences. Roadmap for infrared energy management, quantum information storage.

• **Samsung Electronics, Semiconductor R&D Center**

Staff Engineer, Flash TD · Hwaseong, South Korea

May 2020 – Aug 2021

- *Semiconductor Devices*
- Flash Memory TD (Technology Development) Team. Next generation 3D Vertical-NAND device fabrication and process integration. World's first 2xx layer VNAND working die.
- Charge trap non-volatile memory, word line to bit line interconnect metallization and replacement fabrication process integration.

• **University of Texas at Austin, Milliron Research Group** (nanocrystal.engin.umich.edu)

Graduate Research Assistant · Austin, Texas

Oct 2015 – May 2020

Advisor: Professor Delia J. Milliron

- *Electronic Nanomaterials*
- Synthetic development in n-type doped metal oxide nanocrystals. Infrared (IR) range localized surface plasmon resonance (LSPR) active NC, including shape control and spectral tunability.
- Research in plasmon-exciton interaction between infrared photoluminescent quantum dots and LSPR active nanocrystals, with COMSOL near-field simulations.

• **Harvard-MIT Health Sciences & Technology, Wellman Center for Photomedicine**

Student Research Intern · Boston, Massachusetts
2014

Jun 2014 - Aug

Advisor: Professor Seemantini Nadkarni

- *Laser Optics*
- Summer 2014 Biomedical Optics Program Student Intern; Optical thromboelastography (OTEG) research; Laser speckle rheology imaging device for noninvasive detection of thrombosis.
- Blood coagulation parameter extraction through MATLAB in blood sample subjected to rivaroxaban factor X inhibitor and argatroban compounds.

• **KAIST Electronic Nanomaterial & Devices Laboratory** (dclee.kaist.ac.kr)

Undergraduate Researcher · Daejeon, Korea
2015

Jul 2013 - Aug

Advisor: Professor Doh Chang Lee

- *Display Materials*
- Independent undergraduate research program; design stable and energy efficient electronic materials for display devices.
- Inorganic nanomaterials research for design and synthesis of oxidation stable quantum dots for QLED displays; Bandgap engineered core-shell CdSe/ZnS/ZnO nanocrystal synthesis.
- CdSe/CdS dot-in-rod nanoparticle synthesis.

• **Korea Institute of Science and Technology (KIST)**

Natural Medicine Center Research Assistant · Gangneung, South Korea

Nov 2012 - Feb 2013

Advisor: Dr. Jungyeob Ham

- *Organic Chemistry*
- Marine Chemomics Laboratory; natural cancer drug synthesis.
- Total synthesis of Justicidine B bioactive natural organic compounds through Suzuki-Miyaura reaction; Synthesizing aryl-fluoroborate compound chemical library for compound modification

PUBLICATIONS

Articles:

- DY Park, JH Kang, S Paramasivam, G Duddy, JA Hachtel, JP Camden, I Kim, SH Cho, **Valency-Conserved Doping in Infrared Plasmonic Nanocrystals for Supersonic Shock-Resistant Multi-Level Cell Modulation**, *ACS Appl. Mater. Interfaces.*, **2025**, 17, 36, 50943–50958
- MJ Park, TY Kim, SJ Lee, SY Jung, SH Cho, **Lauroyl Lysine Continuous Injection Synthesis via Schotten-Baumann Reaction pH Optimization as Synthetic Amino Acid Derivative**, *Korean J. Chem. Eng.*, **2025**, <https://doi.org/10.1007/s11814-025-00517-x>
- S Surendhar, I Kim, P Sivaprakash, SH Cho, **Sustainability of Fluorine-Tin Co-Doped Indium Oxide (F,Sn:In₂O₃) Nanocrystals at Various Shock Speeds Under Dynamic Shocked Conditions**, *Natl. Acad. Sci. Lett.*, **2025**, <https://doi.org/10.1007/s40009-025-01724-0>
- SH Cho, DY Park, GY Park, and KM Roccapiore, **Electromagnetically Porous Infrared Plasmonic F,Sn-Doped In₂O₃ Semiconductor Nanocrystals for Infrared Optoelectronic Sensors**, *ACS Applied Nano Materials*, **2024**, 7, 13, 15046–15056
- DY Park, and SH Cho, **Metallic Degenerately Doped Free-Electron-Confined Plasmonic Nanocrystal and Infrared Extinction Response**, *Metals*, **2024**, 14 (8), 843
- Y Wu, A Konečná, SH Cho, DJ Milliron, JA Hachtel, FJ García de Abajo, **Singular and Nonsingular Transitions in the Infrared Plasmons of Nearly Touching Nanocube Dimers**, *ACS Nano*, **2024**, 18, 15130–15138

- G Velmurugan, R Ganapathi, RP Sivaprakash, A Viji, [SH Cho](#) and I Kim, **Functionalization of Fluorine on the Surface of SnO₂-Mg Nanocomposite as an Efficient Photocatalyst for Toxic Dye Degradation**, *Nanomaterials*, **2023**, 13, 2494
- [SH Cho](#), and I Kim, **Hypersonic Shockwave Robustness in Infrared Plasmonic Doped Metal Oxide Nanocrystal Cubes: Implications for High-Speed Ballistics Transport Applications**, *ACS Applied Nano Materials*, **2022**, 5 (12), 17487 - 17495
- KM Roccapiore, [SH Cho](#), AR Lupini, DJ Milliron, and SV Kalinin, **Sculpting the Plasmonic Responses of Nanoparticles by Directed Electron Beam Irradiation**, *Small*, **2021**, 202105099
- SV Kalinin, KM Roccapiore, [SH Cho](#), DJ Milliron, R Vasudevan, M Ziatdinov, and JA Hachtel, **Separating physically distinct mechanisms in complex infrared plasmonic nanostructures via machine learning enhanced electron energy loss spectroscopy**, *Adv. Optical Mater.*, **2021**, 2001808
- KM Roccapiore, M Ziatdinov, [SH Cho](#), JA Hachtel, SV Kalinin, **Predictability of Localized Plasmonic Responses in Nanoparticle Assemblies**, *Small*, **2021**, 2100181
- N Borodinov, P Banerjee, [SH Cho](#), DJ Milliron, O Ovchinnikova, R Vasudevan, and JA Hachtel, **Enhancing Hyperspectral EELS Analysis of Complex Plasmonic Nanostructures with Pan-Sharpener**, *J. Chem. Phys.*, **2021**, 154, 014202
- [SH Cho](#), K Roccapiore, CK Dass, S Ghosh, J Choi, J Noh, LC Reimnitz, S Heo, K Kim, K Xie, BA Korgel, X Li, J Hendrickson, JA Hachtel, and DJ Milliron, **Spectrally Tunable Infrared Plasmonic F:Sn:In₂O₃ Nanocrystal Cubes**, *J. Chem. Phys.*, **2020**, 152, 014709, **Editor's Pick**
- CA Saez Cabezas, ZM Sherman, MP Howard, MN Dominguez, [SH Cho](#), GK Ong, A Green, TM Truskett, and DJ Milliron, **Universal Gelation of Metal Oxide Nanocrystals via Depletion Attractions**, *Nano Lett.*, **2020**, 20 (5), 4007–4013
- S Heo, [SH Cho](#), CJ Dahlman, A Agrawal, and DJ Milliron, **Influence of Crystalline and Shape Anisotropy on Electrochromic Modulation in Doped Semiconductor Nanocrystals**, *ACS Energy Lett.*, **2020**, 5 (8), 2662–2670
- K Kim, LC Reimnitz, [SH Cho](#), J Noh, Z Dong, SL Gibbs, BA Korgel, and DJ Milliron, **Effect of Nonincorporative Cations on the Size and Shape of Indium Oxide Nanocrystals**, *Chem. Mater.*, **2020**, 32 (21), 9347–9354
- M Dominguez, M Howard, J Maier, S Valenzuela, Z Sherman, J Reuther, LC Reimnitz, J Kang, [SH Cho](#), SL Gibbs, A Menta, D Zhuang, A Stok, S Kline, E Anslyn, T Truskett, and DJ Milliron, **Assembly of Linked Nanocrystal Colloids by Reversible Covalent Bonds**, *Chem. Mater.*, **2020**, 32 (23), 10235–10245
- S Ghosh, HC Lu, [SH Cho](#), T Maruvada, MC Price, and DJ Milliron, **Colloidal ReO₃ Nanocrystals: Extra Re d-Electron Instigating a Plasmonic Response**, *J. Am. Chem. Soc.*, **2019**, 141 (41), 16331–16343
- [SH Cho](#), S Ghosh, ZJ Berkson, JA Hachtel, J Shi, X Zhao, LC Reimnitz, CJ Dahlman, Y Ho, A Yang, Y Liu, JC Idrobo, BF Chmelka, and DJ Milliron, **Syntheses of Colloidal F:In₂O₃ Cubes: Fluorine-Induced Faceting and Infrared Plasmonic Response**, *Chem. Mater.*, **2019**, 31 (7), 2661–2676
- TD Siegler, LC Reimnitz, M Suri, [SH Cho](#), A Bergerud, M Abney, DJ Milliron, and BA Korgel, **Deliquescent Chromism of Nickel (II) Iodide Thin Films**, *Langmuir*, **2019**, 35 (6), 2146–2152
- TD Siegler, DW Houck, [SH Cho](#), DJ Milliron, and BA Korgel, **Bismuth Enhances the Stability of CH₃NH₃PbI₃ (MAPI) Perovskite under High Humidity**, *J. Phys. Chem. C*, **2019**, 123 (1), 963–970

- BH Kim, CM Staller, SH Cho, S Heo, CE Garrison, J Kim, and DJ Milliron, **High Mobility in Nanocrystal-Based Transparent Conducting Oxide Thin Films**, *ACS Nano*, **2018**, 12 (4), 3200–3208
- A Agrawal, SH Cho, O Zandi, S Ghosh, RW Johns, and DJ Milliron, **Localized Surface Plasmon Resonance in Semiconductor Nanocrystals**, *Chem. Rev.*, **2018**, 118 (6), 3121–3207

Oral Presentations:

- SH Cho, S Ghosh, ZJ Berkson, JA Hachtel, J Shi, X Zhao, LC Reimnitz, CJ Dahlman, Y Ho, A Yang, Y Liu, JC Idrobo, BF Chmelka, and DJ Milliron, **Syntheses of colloidal F:In₂O₃ cubes: Fluorine-induced faceting and infrared plasmonic response**, ACS Fall National Meeting & Exposition, San Diego, 2019
- SH Cho, K Roccapiore, CK Dass, S Ghosh, J Choi, J Noh, LC Reimnitz, S Heo, K Kim, K Xie, BA Korgel, X Li, J Hendrickson, JA Hachtel, and DJ Milliron, **Spectrally Tunable Infrared Plasmonic F,Sn:In₂O₃ Nanocrystal Cubes**, Nano GE, 2020, Selected Talk

Poster Presentations:

- SH Cho, K Roccapiore, CK Dass, S Ghosh, J Choi, J Noh, LC Reimnitz, S Heo, K Kim, K Xie, BA Korgel, X Li, J Hendrickson, JA Hachtel, and DJ Milliron, **Spectrally Tunable Infrared Plasmonic F,Sn:In₂O₃ Nanocrystal Cubes**, Oak Ridge National Laboratory CNMS User Meeting, 2020
- SH Cho, S Ghosh, ZJ Berkson, JA Hachtel, J Shi, X Zhao, LC Reimnitz, CJ Dahlman, Y Ho, A Yang, Y Liu, JC Idrobo, BF Chmelka, and DJ Milliron, **Infrared Plasmonic Response and Fluorine-Induced Faceting in Colloidal F:In₂O₃ Nanocubes**, Oak Ridge National Laboratory CNMS User Meeting, 2019
- SH Cho, D Tshikudi, M Tripathi, S Nadkarni, **Optical Thromboelastography for Monitoring Anticoagulant Dosing**, Harvard-MIT HST Summer Institute for Biomedical Optics Program, 2014
- SH Cho, S Lee, **Ultra-stable CdSe/ZnS/ZnO Core Shell Quantum Dots for Next-Generation QD-LED Display Devices**, KAIST Undergraduate Research Participation Program, 2014

TECHNICAL SKILLS

Experimental Skills:

- *Nanocrystal Synthesis*: LSPR n-type doped metal oxide nanocrystal (NC) synthesis (Sn:In₂O₃, Ce:In₂O₃, F:In₂O₃, In:CdO), Excitonic quantum dot (QD) synthesis (CdSe, PbS, PbSe), CdSe/ZnS core shell QD, Alloyed CdSeS core shell QD, CdSe/CdS dot-in-rod, InP cadmium free QD, Hot-injection, Heat-up, Continuous injection colloidal synthesis, Ligand stripping, SERS active Ag nanoparticle
- *VLSI Microfabrication*: Lithography, Dopant predeposition and drive, Gate oxide growth, Wet etching, MOSFET I-V C-V measurement
- *Organic Chemistry*: Natural compound total synthesis (Justicidine B), Aryl-fluoroborate compound, Palladium catalyzed Suzuki cross coupling reaction, Grubbs catalyst metathesis
- *Computational Chemistry*: Ligand bound surface energy computation (VASP)
- *Process Engineering*: Process flow diagram design of tert-butanol production process with AspenPlus, Omron PLC Automation Control
- *Biochemistry*: Drug compound testing in red blood cells (Argatroban, Rivaroxaban)

Instrument Skills:

- *Instruments*: SEM, HRTEM, SAED, XRD, EDX, XPS, NMR, TOF-SIMS, AFM, DLS, UV-Vis-NIR, FTIR, Raman Spectroscopy, PL Spectroscopy, Ultrafast Laser Spectroscopy (TCSPC), ALD, Spin-coating, Spray-coating, Two-phase Assembly, HPLC, TLC, Column Chromatography, Cyclic Voltammetry, Hall Measurement, Photolithography, Glovebox
- *Programs*: MATLAB, COMSOL, Python, Jupyter, NumPy, C, Java, R, SQL, HTML CSS, Excel, Adobe Illustrator, Origin, CrystalMaker, VESTA, AspenPlus, NionSwift, SPICE, Verilog

COURSEWORK

- **Chemistry:**
 - Physical Chemistry I, II,
 - Molecular Spectroscopy
 - Quantum Chemistry
 - Advanced Quantum Mechanics
 - Physical Organic Chemistry
 - Organic Chemistry I, II
 - Organic Synthesis
 - Inorganic Chemistry I
 - Advanced Inorganic Chemistry
 - Analytical Chemistry
 - Biochemistry
 - Molecular Biology
 - Chemistry Major Lab
- **Chemical Engineering:**
 - Chemical and Biomolecular Engineering Analysis
 - Thermodynamic and Energy Systems
 - Reaction Engineering
 - Heat and Molecular Transfer
 - Fluid Mechanics
 - Nanochemical Technology
 - Nanobiotechnology
 - Chemical and Biomolecular Engineering Laboratory
- **Graduate Courses:**
 - Molecular Engineering Laboratory
 - Macromolecular Engineering
 - Materials Science and Engineering
 - Process Simulation and Control
 - Introduction to Programming
 - Communications for Design
 - Materials Physics
 - Electromagnetic Theory
 - Ultra Large Scale Integration
 - Electrochemistry
 - Inorganic Reactions and Structure
 - X-Ray Diffraction Theory
 - Fluid Flow and Heat Transfer
 - Energy Technology and Policy
- **Audited Courses:**
 - VLSI I
 - Microarchitecture
 - Practical Electron Microscopy
 - Nanoscale Device Physics and Technology
 - Magnetic Materials and Devices
 - Quantum Information Hardware
 - Nuclear and Radiochemistry

AWARDS

- **Miwon Young Scientist Award 2024**, Korean Society of Industrial and Engineering Chemistry (KSIEC)
- **Oak Ridge National Laboratory CNMS User Meeting, 2019 Poster Award, Bronze**, *Infrared Plasmonic Response and Fluorine-Induced Faceting in Colloidal F:In₂O₃ Nanocubes*
- **Dean's List (KAIST Department of Chemical and Biomolecular Engineering)**, KAIST College of Engineering, Spring 2014
- **KAIST Undergraduate Research Project 2013, Award of Excellence**, *Ultra-stable CdSe/ZnS/ZnO Core Shell Quantum Dots for Next-Generation QD-LED Display Devices*
- **American Institute of Chemical Engineers, KAIST-AIChE Student Chapter President**, Academic Year 2014-2015
- **Korea Foundation for the Advancement of Science and Creativity (KOFAC)**, 2013 Life of a Scientist Exhibition Award
- **ICISTS-KAIST 2009, Best Team Project Award**, Nano Clinic Workshop
- **KAIST Freshmen Design 2009, Poster Award**, *Design of Emergency Shelter for Earthquake in Indonesia*
- **KAIST Department of Humanities and Social Sciences Best Paper Award 2013**, *How Anonymous (Dangerously) Saved Wall Street Hacktivism, and a Path to Safer Internet Social Movement*, Second Prize

FUNDINGS & SCHOLARSHIPS

- **Fulbright Scholarship**, Fulbright Foreign Student Program (2015~2016)
- **University of Texas at Austin Graduate Dean's Prestigious Fellowship** (2015 Fall ~ 2016 Summer)
- **Thomas H. and Dorothy M. Timmins Endowed Graduate Fellowship** (2015 Fall, 2019 Fall)
- **Korea Student Aid Foundation, National Scholarship Recipient** (Feb. 2009 ~ Nov. 2014)

- **KAIST Undergraduate Research Continuous Fund** (Feb. ~ Dec. 2014)
- **KAIST Undergraduate Research Project 2013** (Jun. ~ Nov. 2013)
- **Harvard-MIT HST, Wellman Center for Photomedicine Intern Support Fund** (Jun. ~ Aug. 2014)

CONFERENCES

- **AAAS Annual Meeting**, 2018, Austin, Texas
- **Harvard-MIT HST Summer Institute for Biomedical Optics Poster Presentation**, 2014, Boston
- **Quantum Dots: Promises and Challenges**, 2013, Daejeon, South Korea
- **9th World Congress of Chemical Engineering**, 2013, Seoul, South Korea
- **KAIST Undergraduate Research Participation (URP) Program**, Research Presenter
- **KAIST / Oxford University / UC Irvine 2013 MOU**, Student Press Reporter/Interviewer
- **ICISTS-KAIST 2012**, Age of Integration: Beyond the Borders of Knowledge
- **ICISTS-KAIST 2010**, Sustainable Energy, Organization Committee
- **Korea Student Aid Foundation, 2010 Mentor Program**, Mentee for KAIST President Nam Pyo Suh
- **ICISTS-KAIST 2009**, Nano Clinic Workshop
- **International Presidential Forum 2009**, Challenges to Global Research Universities, Student Press
- **Harvard Project for Asian and International Relations 2009**, Understanding Security Issues in East Asia

COLLABORATORS

• Collaborators

Oak Ridge National Laboratory – Dr. Jordan A. Hachtel, Dr. Kevin M. Roccapiore, Dr. Juan-Carlos Idrobo

University of California Santa Barbara – Dr. Zachariah J. Berkson, Dr. Bradley F. Chmelka

Air Force Research Laboratory – Dr. Chandriker Dass, Dr. Josh Hendrickson

Lawrence Berkeley National Laboratory – Dr. Ankit Agrawal

Pennsylvania State University – Dr. Evan L. Runnerstrom, Dr. John-Paul Maria

City College of New York – Dr. Lauren O'Donnell, Dr. Robert J. Messinger

University of Texas at Austin – Dr. Brian A. Korgel, Timothy D. Siegler, Jungchul Noh, Dr. Yuanyue Liu, Jianjian Zhi, Xunhua Zhao, Dr. Xiaoqin (Elaine) Li, Junho Choi, Dr. Sandeep Ghosh, Dr. Molly Jhong, Dr. Gary K. Ong, Dr. Sungyeon Heo, Dr. Byung Hyo Kim, Dr. Corey Staller, Dr. Clayton Dahlman, Lauren Reimnitz, Kihoon Kim, Camila A. Saez Cabezas

• Undergraduate Mentorship

Karen Xie (2019) – UT Austin Chemical Engineering

Naveen Chokkar (2017) – UT Austin Chemical Engineering

Allison Foster (2017) – Austin Community College (Current Status: UT Austin Chemical Engineering)

Anni Yang (2016 - 2018) – UT Austin Chemical Engineering (Current Status: Schlumberger)

Yujing Ho (2016 - 2018) - UT Austin Chemical Engineering (Current Status: Baker Engineering)

PROFESSIONAL SOCIETY

• American Chemical Society

ACS Member, #31564406 · Central Texas

Jun 2019

• American Alpine Club

Student Member, #89904

Jan 2019

Alpine, Mixed Climb, Top Rope, Lead Climb. Ice Axe, Crampon experienced. Climbs: Mt Whitney CA, Mt Elbert CO, Mt Hood OR, Mt St Helens WA, Guadalupe Peak TX, Borah Peak ID, Wheeler Peak NM, Mica Mountain AZ.

• Texas Board of Professional Engineers

Engineer in Training, #60497 (FE, PE Exam Passed) · Austin, Texas Sep 2017

- **Gemological Institute of America (GIA)**

Applied Jewelry Professional · Austin, Texas June 2016

- **UT Austin Korean Student Association, Chemical Engineering (UTKSA-ChE)**

President · Austin, Texas Sep 2015 – Jan 2017

- **AIChE Student Chapter**

President, Founding Member · Daejeon, Korea Feb 2014 – July 2015

Advisor: Professor Doh Chang Lee

Founding member and President for AIChE (American Institute of Chemical Engineers) Student Chapter in KAIST. Engagement in International Sister Chapter with Massachusetts Institute of Technology (MIT). Projects include directing students competing in annual AIChE Chem-E-Car Competition.

- **The KAIST Herald**

Senior Staff Reporter · Daejeon, Korea Feb 2009 – Jun 2015

Official English newspaper of Korea Advanced Institute of Science and Technology; Reporter for Interviews, News, and Science & Technology Section; Exclusive interviews and coverage: 2002 Nobel Chemistry Prize Laureate Kurt Wüthrich, 2005 Nobel Chemistry Prize Laureate Robert H. Grubbs, Oxford University Vice Chancellor Andrew Hamilton.

- **ICISTS-KAIST (Sustainable Energy Workshop)**

Coordination & Planning · Daejeon, Korea Feb 2010 – Sep 2010

Student-run international conference organizer for experts and delegates to discuss technological and socio-economic aspects on sustainable energy technology. Invited speakers from Seoul National University, UC Davis, National Fusion Research Institute, and United Nations Development Programme for in-depth discussions on smart grids, appropriate technology, and nuclear fusion.

MILITARY SERVICE

- **ROK Army**

Sergeant Operations Staff · 23rd Division 1607 Battalion · Gangneung, Korea Feb 2011 – Nov 2012

Regional military reserve forces management; Local municipal administration; Regional defense operation; ROKA Level 2 Security Clearance.

LANGUAGE SKILLS

- Native: English and Korean
- GRE : Verbal 157/170, Quantitative 170/170, Analytical Writing 3.5/6.0
- TOEFL : 116/120 (Reading 30, Listening 30, Speaking 28, Writing 28)
- TOEIC : 990/990