Cheoljae Lee

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Education

M.S/Ph.D. Integrated	Energy Science and Engineering (Prof. Ju-Hyuck Lee)	2024.02~2026.02 2019.09~2022.06	DGIST (Republic of Korea)
Bachelor	School of Undergraduate Studies	2015.03~2019.08	DGIST (Republic of Korea)

Skills

Equipment	**Fabrication** (Thermal evaporator, 3D printer) **Characterization** (SEM, XRD, AFM, OM) **Measurement** (Oscilloscope, Electrometer, Sourcemeter, LCR meter, Function generator & Amplifier, Universal testing machine)
Software	**COMSOL Multiphysics** (Simulation)**, Rhinoceros 3D** (3D modeling)**, Keyshot** (3D rendering)

EXPERTISE

- Electrocoagulation/Electrophoretic based micro/nanoparticle (Microplastic, ceramic, metal oxide) removal system
- Electric field based particle control system
- Electrostatic device based body electrostatic discharge prevention system
- Micro/nano surface structuring and analysis
- Completed education of COMSOL Multiphysics, ALTSOFT, Dec 2021

SCI Paper publication

	First author	Co-author	Total
Paper (#)	4	11	15
Impact factor	54.98	151.13	221.81

Selected Project Experience

Project Title	**Electrophoretic Micro/Nano Particle Removal System (2020.03 – 2022.06)**
Organization	**DGIST, KITECH**
Project detail, Achievements	• Aimed to develop a technology for removing toxic micro/nano-sized particles (e.g., microplastics, heavy metals, oxides) that cannot be filtered using membrane-based methods. • Designed and fabricated a high-voltage, low-current energy device based on porous and patterned surfaces. • Combined the energy device with Electrophoretic Deposition (EPD) principles to realize a novel particle deposition technique. • Analyzed particle removal using zeta potential measurements, fluorescence microscopy, SEM, and EDS. • Optimized core parameters including voltage, current, and treatment time to maximize removal efficiency. • Published in Nano Energy (2022)

Project Title	**Wireless and Battery-Free ESD Protection System (2021.03 – 2022.06)**
Organization	**DGIST**
Project detail, Achievements	• Aimed to develop a human-body ESD prevention system that does not require grounded wiring or conventional ionizers. • Investigated the principle that human body potential rises positively due to friction with clothing or shoes. • Designed a low-current device using triboelectric charge generation to supply negative charges to the human body. • Experimentally derived optimal neutralization conditions by adjusting device output, dielectric material, and humidity. • Created anti-static shoes and secured in research funding (₩64,000,000). • Published in Nano Energy (2022)

Project Title	**Contactless Particle Removal via Electrodynamic Screen (EDS) (Mar. 2021 – Jun. 2025)**
Organization	**DGIST, Samsung Electronics**
Project detail, Achievements	• Aimed to develop a contactless particle removal system applicable to indoor (home appliance) and outdoor (solar panel) environments. • Designed EDS structures and optimized electrode patterns using electrophoretic and dielectrophoretic principles. • Selected and applied high-dielectric, high-breakdown materials for stable high-voltage operation. • Conducted DRE (dust removal efficiency) experiments by adjusting electrode gap, waveform, frequency, and voltage. • Transitioned from single-phase to three-phase EDS systems, enabling directional control of particles. • Extended the research into a self-powered EDS system driven by wind • Published in Nano Energy (2025)

Project Title	**Development of a Microplastic Rapid Electrocoagulation Module (2024.03 – present)**
Organization	**DGIST, Samsung Electronics**
Project detail, Achievements	• Aimed to aggregate sub-micrometer microplastics discharged from washing machines into filterable sizes. • Addressed the limitations of conventional electrocoagulation systems that require separate tanks and cannot perform real-time treatment • Designed and fabricated a rapid electrocoagulation module operable during washing machine discharge. • Experimentally optimized electrochemical parameters (voltage, electrode gap, surface area) for high-speed aggregation. • Performed flow simulations based on experimental data to derive the optimal module structure. • Verified coagulation and filtration performance in real washing machine conditions.

Publications

[1] Self-Powered Directional Dust Removal via Wind-Driven Phase-Controlled TENG for Solar Panel Maintenance
Cheoljae Lee†, Junyeong Yang†, Soo-Kwan Kim, Yugyung Jin, Hyosik Park, Sujeong Gwak, Gerald Selasie Gbadam, Jimin Yeon, Yeonkyeong Ryu, Jongsung Lee, Seongho Son, Jeongnam Cheon, Jongmin Choi, Wanchul Seung*, Ju-Hyuck Lee*
Nano Energy,111262 (2025) / **Equal First author** / [Impact Factor: 17.56]

[2] Electrostatic discharge prevention system via body potential control based on a triboelectric nanogenerator
Cheoljae Lee, Minsu Heo, Hyosik Park, Hyeonseo Joo, Wanchul Seung*, Ju-Hyuck Lee*
Nano Energy, 103, 107834 (2022) / **First author** / [Impact Factor: 17.56]

[3] Toxic micro/nano particles removal in water via triboelectric nanogenerator
Byung-Geon Park†, **Cheoljae Lee**†, Young-Jun Kim, Jinhyoung Park, Hyeok Kim, Young Jung, Jong Soo Ko, Sang-Woo Kim*, Ju-Hyuck Lee*, Hanchul Cho*
Nano Energy, 100, 107433 (2022) / **Equal First author** / [Impact Factor: 17.56]

[4] Recent Structure Development of Poly(vinylidene fluoride)-Based Piezoelectric Nanogenerator for Self-Powered Sensor
Cheoljae Lee†, Hyosik Park†, Ju-Hyuck Lee*
Actuators. 9, 57 (2020) / **Equal First author** / [Impact Factor: 2.3]

[5] Direct current generation in triboelectric nanogenerators through ionic dynamics and electrode polarization effects
Gerald Selasie Gbadam, Hyosik Park, Cheoljae Lee, Hyeonseo Joo, Sujeong Gwak, Hong-Joon Yoon, Hanjun Ryu, Sang Min Lee, Ju Hun Lee, Ju-Hyuck Lee*
Nature Communications, 16, 9540 (2025) / **co-author** / [Impact Factor: 15.7]

[6] Reconfiguring Hierarchical Porous Architecture of 2D Metal Nanosheets for Multifunctional Triboelectric Nanogenerators
Dae-Hong Kim, Ju-Hyoung Yu, **Cheoljae Lee**, Min-Young Seo, Seungyeon Kim, Hyeonji Joo, Young-Seok Song, Sukang Bae, Ju-Hyuck Lee, Seoung-Ki Lee*, Tae-Wook Kim*
Advanced Materials, e15466 (2025) / **co-author** / [Impact Factor: 26.8]

[7] Polyelectrolytes as a Stable and Tunable Platform for Triboelectric Nanogenerators
Hyeonseo Joo†, Sujin Park†, Sujeong Gwak, Hyosik Park, Soyoung Kim, **Cheoljae Lee**, Wonho Lee* and Ju-Hyuck Lee*
Advanced Materials, 2505547 (2025) / **co-author** / [Impact Factor: 26.8]

[8] Ion diffusivity and alkyl chain length-dependent triboelectric behavior of PVDF-HFP+ IL composites
Sujeong Gwak, Hyeonseo Joo, Bonhyeop Koo, **Cheoljae Lee**, Hyosik Park, Hochun Lee, Ju-Hyuck Lee
Nano Trends, 10, 100104 (2025) / **co-author** /

[9] Interfacial Triboelectricity Lights Up Phosphor-Polymer Elastic Composites: Unraveling the Mechanism of Mechanoluminescence in Zinc Sulfide Microparticle-Embedded Polydimethylsiloxane Films
Gyudong Lee, Seongkyu Song, Woo Hyeon Jeong, **Cheoljae Lee**, June-Seo Kim, Ju-Hyuck Lee, Jongmin Choi, Hyosung Choi, Younghoon Kim, Sung Jun Lim, Soon Moon Jeong

Small, 2307089 (2024) / **co-author** / [Impact Factor: 13.59]

[10] Self-powered electrodynamic dust removal for sustainable solar panels using triboelectric nanogenerators
Minsu Heo, Junyeong Yang, Bosung Kim, **Cheoljae Lee**, Hyosik Park, Soo-Kwan Kim, Jongsung Lee, Seongho Son, Jeongnam Cheon, Jongmin Choi, Wanchul Seung*, Sang-Woo Kim*, Ju-Hyuck Lee*
Nano Energy, 121, 109257 (2024) / **co-author** / [Impact Factor: 17.56]

[11] Plasticizer structural effect for sustainable and high-performance PVC gel-based triboelectric nanogenerators
Hyosik Park, Seung-Ju Oh, Mingyu Kim, **Cheoljae Lee**, Hyeonseo Joo, Jin Woo Bae*, Ju-Hyuck Lee*
Nano Energy, 114, 108615 (2023) / **co-author** / [Impact Factor: 17.56]

[12] Functionalized thermoplastic polyurethane with tunable tribopolarity and biodegradability for high performance and biodegradable triboelectric nanogenerator
Hyeonseo Joo, Sujeong Gwak, Mun Hwan Lee, Hyosik Park, **Cheoljae Lee**, Ju Hun Lee, Sang A Han*, Ju-Hyuck Lee*
Sustainable Materials and Technologies, 36, e00638 (2023) / **co-author** / [Impact Factor: 10.16]

[13] High Performance and Direct Current Piezoelectric Nanogenerators Using Lithium-doped Zinc Oxide Nanosheets
Jeongeun Kim†, Yuseok Kim†, Yerin Kim, **Cheoljae Lee**, Ju-Hyuck Lee*
Energy Technology, 2201453 (2023) / **co-author** / [Impact Factor: 3.88]

[14] Self-assembly of unidirectionally polarized piezoelectric peptide nanotubes using environmentally friendly solvents
Hyojin Park†, Yuseok Kim†, Yerin Kim, **Cheoljae Lee**, Hyosik Park, Hyeonseo Joo, Ju Hun Lee*, Ju-Hyuck Lee*
Applied Surface Science, 618, 156588 (2023) / **co-author** / [Impact Factor: 7.21]

[15] Control of the Biodegradability of Piezoelectric Peptide Nanotubes Integrated with Hydrophobic Porphyrin
Yerin Kim, Hyojin Park, Yuseok Kim, **Cheoljae Lee**, Hyosik Park, Ju-Hyuck Lee*
ACS Applied Materials & Interfaces, 14, 38778-38785 (2022) / **co-author** / [Impact Factor: 8.26]

[16] Plasticized PVC-Gel Single Layer-Based Stretchable Triboelectric Nanogenerator for Harvesting Mechanical Energy and Tactile Sensing
Hyosik Park†, Seung-Ju Oh†, Daeyeong Kim, Mingyu Kim, **Cheoljae Lee**, Hyeonseo Joo, Insun Woo, Jin Woo Bae, Ju-Hyuck Lee*
Advanced Science, 9, 2201070 (2022) / **co-author** / [Impact Factor: 14.1]

[17] Direct-current flexible piezoelectric nanogenerators based on two-dimensional ZnO nanosheet
Yoonjung Lee†, Sohee Kim†, Daeyeong Kim, **Cheoljae Lee**, Hyojin Park, Ju-Hyuck Lee*
Applied Surface Science, 509, 145328 (2020) / [Impact Factor: 7.21]

Patents

[1] APPARATUS AND METHOD OF PREVENTING OCCURRENCE OF STATIC ELECTRICITY USING ENERGY HARVESTER
Registration No. 10-2520769-0000 (Korea)

[2] UNIDIRECTIONAL DUST REMOVAL DEVICE USING AN ENERGY HARVESTING ELEMENT AND CONTROL METHOD THEREOF
Application No. 10-2025-0071337 (Korea)

Experience

Robot Locomotion Technology Researcher, Korea Army, Republic of Korea 2022. 06 -2023. 12

Animal Behavior and Circadian Rhythm Lab Intern, DGIST, Republic of Korea 2017

Advisor : Prof. Han Kyoung Choe

Honors/Awards

Best Poster Award, The 3rd Global Conference of Innovation Materials 2025

Best Student Award, Energy Science and Engineering, DGIST 2022

Reference

Prof. Ju-Hyuck Lee, Ph.D. (Ph.D. thesis supervisor)

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