

Byungseok Seo, PhD

Curriculum vitae

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Education/Employment

- Apr. 2024 – present **Research Associate**, Northwestern University Atomic and Nanoscale Characterization Experimental (NUANCE) Center, Evanston, IL
- Sep. 2023 – Mar. 2024 **Research Professor** in Research Institute of Innovative Mechanical Design Technology, Korea university, Seoul, Republic of Korea
- Mar. 2022 – Aug. 2023 **Researcher** in Research Institute of Innovative Mechanical Design Technology, Korea university, Seoul, Republic of Korea
- Mar. 2016 – Feb. 2022 **Ph.D.** in school of mechanical engineering, Korea university, Seoul, Republic of Korea
- Mar. 2012 – Feb. 2016 **B.S.** in school of mechanical engineering, Korea university, Seoul, Republic of Korea

Research Experience

- **Researcher at Korea university** / Mar. 2022 – Aug. 2023 (Military service)
(With Research Institute of Innovative Mechanical Design Technology (PI: Yun-Jae Kim))
Development of micropixelation-free tactile sensors based on triboelectricity
Investigation of tribo-electric field propagation phenomenon for multifunctional electronics
Development of humidity-thermoelectric bimodal energy harvesters
- **A development of nanopore chip for protein sequencing** / Jun. 2021 – Aug. 2022
(With Manufacturing and Technology Division, Bertis Inc., Republic of Korea)
Development of nanopore membrane via TEM-drilling method and platform setup
Analysis of electrical signal characteristics for target materials detection
- **A development of integrated multi-mode energy harvesting environmental IoT sensor platform** / Jul. 2017 – Dec. 2021
(With Korea Evaluation Institute of Industrial Technology)
Optimal design of energy harvesting devices for enhancing power generation performance

Analysis of energy harvesting output signals for self-powered sensor technology

Development of self-powered dual-output fluid sensors for environmental IoT sensor platform

- **Graduate Student Researcher** / Mar. 2016 – Feb. 2022

(With Multiscale Transport Laboratory, Korea university, Republic of Korea)

Thesis: Thermal-Mechanical-Electrochemical Energy Harvesting and Sensing for Self-sustainable Platform (Advisor: Wonjoon Choi)

Development of energy harvester/sensor hybrid devices for wearable electronics

Signal manipulation of energy harvesting mechanisms for sustainable power generation

Development of synthesis method for tunable organic/metal oxide hybrid composites for electrochemical energy conversion applications

- **Undergraduate Researcher** / Mar. 2014 – Feb. 2016

(With Wonjoon Choi's Multiscale Transport Laboratory, Korea university, Republic of Korea)

Development of mask-less patterning method for CVD-grown carbon nanotubes (CNTs)

Teaching Experience

- **Creative design** / Teaching Assistant / 2017 Fall
- **Integrated design** / Teaching Assistant / 2018 Spring
- **Mechanical engineering laboratory** / Teaching Assistant / 2018 Fall
- **Creativity in machine design: capstone design** / Teaching Assistant / 2019 Spring

Awards and Honors

- Brain Korea (BK) 21 Plus Scholarships National Research Foundation of Korea (NRF) / 2016-2020
- Teaching Assistant (TA) scholarships Korea University / 2016, 2017, 2019
- Research Assistant (RA) scholarships Korea University / 2017, 2018
- Campustown startup competition Seoul Metropolitan Government / 2017
- Korea university R&D CEO course Korea University / 2016
- The honor student award Korea University / 2014
- K2 global leadership program Keio University (Japan) / 2013
- Test of Economic Sense And Thinking (TESAT) The Korea Economic Daily, Hankyung / 2013
- The honor student award Korea University / 2013
- Science prodigy scholarship Korea University / 2012

Publications

‡ denotes first authored

- [1] **Seo. B.S.‡**; Noh. D.W.‡; Choi. Y.; Choi. W.*; “Mechanical stimuli-driven pseudo-conductive channel formation along dielectric interfaces for electrical transformation”, **In progress**.
- [2] **Seo. B.S.‡**; Kim. D.H.‡; Park. S.H.; Choi. W.*; “Electrothermally-tailored lithiophilic Co/Co_xO_y@porous graphite composites for advancing Li-ion-metal hybrid battery performance”, **In progress**.
- [3] **Seo. B.S.‡**; Choi. Y.‡; Noh. D.W.; Choi. W.*; “Minimizing electrode footprint in tactile sensors for human interactive wearable and implantable electronics”, **In progress**.
- [4] **Seo. B.S.‡**; Kim. K.M.; Choi. W.*; “Nucleation energy control of carbon-based substrates for tunable transition metal/metal oxide composites”, **In progress**.
- [5] **Seo. B.S.‡**; Lee. J.H.‡; Chae. S.H.; Kim. K.M.; Choi. W.*; “Fabrication of MWCNT-Mn_xO_y sphere hybrid structure via electrical sparks combined DC-CWs for high-performance supercapacitor electrode”, **In progress**.
- [6] Yeo. T.H.‡; Kim. K.M. ‡; Lee. J.H.; **Seo. B.S.**; Park. S.H.; Choi. W.*; “Studies toward morphological changes of silver/carbon fiber composites and their optimization for high-performance electrochemical electrodes”, **International Journal of Energy Research**, **2024**. (accepted)
- [7] Shin. D.J.‡; Chae. S.H.‡; Park. S.H.; **Seo. B.S.**; Choi. W.*; “Rational engineering of high-entropy oxides for Li-ion battery anodes with finely tuned combustion syntheses”, **NPG Asia Materials**, **2023**, 15, 54. <https://doi.org/10.1038/s41427-023-00502-y>
- [8] Song. C.H.‡; Lee. J.M. ‡; **Seo. B.S.**; Choi. W.*; “Enhanced cooling performance of three-dimensional printed heat sink via solution-processed layer-by-layer coatings”, **Advanced Engineering Materials**, **2023**, 25, 2300669. <https://doi.org/10.1002/adem.202300669>
- [9] Park. S.H.‡; **Seo. B.S.**; Shin. D.J.; Chae. S.H.; Cho. H.J.; Kim. S.T.; Choi. W.*; “Synthesis of carbon nanotube-iron oxide composites via combustion waves for hybrid Li-ion battery anodes”, **Chemical Engineering Journal**, **2023**, 470, 144260. <https://doi.org/10.1016/j.cej.2023.144260>
- [10] Lee. J.M.‡; Kim. J.H. ‡; **Seo. B.S.**; Shin. D.J.; Hwang. S.H.; Choi. W.*; “Layer-by-layer solution-processed two-dimensional graphene oxide–polyethylenimine thin-film coatings for enhanced pool boiling heat transfer”, **International Journal of Heat and Mass Transfer**, **2023**, 209, 124067. <https://doi.org/10.1016/j.ijheatmasstransfer.2023.124067>
- [11] **Seo. B.S.‡**; Cha. Y.S.‡; Choi. Y.; Kim. S.T.*; Choi. W.*; “Rationally designed micropixelation-free tactile sensors via contour profile of triboelectric field propagation”, **Nano Energy**, **2023**, 109, 108255. <https://doi.org/10.1016/j.nanoen.2023.108255>
- [12] **Seo. B.S.‡**; Han. H.S.; Kim. K.M.; Noh. D.W.; Shim. J.H.; Choi. W.*; “Humidity-thermoelectric bimodal energy harvester for sustainable power generation”, **Nano Energy**, **2023**, 107, 108120. <https://doi.org/10.1016/j.nanoen.2022.108120>
- [13] Kim. W.S.‡; Shin. D.J.; **Seo. B.S.**; Chae. S.H.; Jo. E.M.; Hong. Y.R.; Choi. W.*; “Precisely tunable synthesis of binder-free cobalt oxide-based Li-ion battery anode using scalable electrothermal waves”, **ACS Nano**, **2022**, 16 (10), 17313-17325. <https://doi.org/10.1021/acsnano.2c08115>
- [14] Cha. Y.S.‡; Kim. T.W.‡; **Seo. B.S.**; Choi. W.*; “Combustion-driven synthesis route for bimetallic Ag-Bi nanoparticle-anchored carbon nanotube electrodes for high-performance supercapacitors”, **Carbon**, **2022**, 198, 11-21. <https://doi.org/10.1016/j.carbon.2022.07.003>
- [15] Kim. K.M.‡; **Seo. B.S.‡**; Park. S.H.; Shin. D.J.; Kim. S.S.; Choi. W.*; “Electrothermally driven nucleation energy control of defective carbon and nickel-cobalt oxide-based electrodes capable of electrochemical activation”, **ACS Nano**, **2022**, 16 (6), 9772-9784. <https://doi.org/10.1021/acsnano.2c03500>

- [16] **Seo. B.S.**‡; Shin. I.C.; Cha. Y.S.; Kim. K.M.; Choi. W.*; “Ultrahigh thermopower waves in carbon nanotube-antimony telluride composites enabled by thermal decomposition of formaldehyde”, **International Journal of Energy Research**, **2022**, 46 (7), 9926-9937. <https://doi.org/10.1002/er.7839>
- [17] **Seo. B.S.**‡; Kim. W.S.‡; Park. S.H.; Song. C.H.; Kim. S.S.; Choi. W.*; “Electrothermally tunable morphological and redox design of heterogeneous Pd/Pd_xO_y/carbon for humidity-hydrion-driven energy harvester”, **Nano Energy**, **2022**, 95, 107053. <https://doi.org/10.1016/j.nanoen.2022.107053>
- [18] Cha. Y.S.‡; **Seo. B.S.**‡; Chung M.K.‡; Kim B.S.Y.; Choi. W.*; Park W.S.*; “Skin-Inspired Thermometer Enabling Contact-Independent Temperature Sensation via a Seebeck-Resistive Bimodal System”, **ACS Applied Materials & Interfaces**, **2022**, 14 (15), 17920-17926. <https://doi.org/10.1021/acsami.1c24420>
- [19] Park. S.H.‡; **Seo. B.S.**; Shin. D.J.; Kim. K.M.; Choi. W.*; “Sodium-chloride-assisted synthesis of nitrogen-doped cube-like hierarchically porous carbon shells via one-step combustion waves for high-performance supercapacitors”, **Chemical Engineering Journal**, **2022**, 433, 134486. <https://doi.org/10.1016/j.cej.2021.134486>
- [20] Yeo. T.H.‡; **Seo. B.S.**; Lee J.H.; Park. S.H.; Kim K.M; Choi. W.*; “Ultrafast Extreme Thermal–Electrical Fabrication of Volcano-Shape-like Core-Shell Ag-Mn_xO_y Branches anchored on Carbon as High-Performance Supercapacitor Electrodes”, **Nano Energy**, **2022**, 91, 106663. <https://doi.org/10.1016/j.nanoen.2021.106663>
- [21] **Seo. B.S.**‡; Cha. Y.S.; Kim. S.T.*; Choi. W.*; “Tunable current duration in triboelectric generators via capacitive air gaps”, **International Journal of Energy Research**, **2021**, 45 (4), 5619-5628. <https://doi.org/10.1002/er.6188>
- [22] Park. S.H.‡; Shin. D.J.; Yeo. T.H.; **Seo. B.S.**; Hwang. H.Y.; Lee. J.H.; Choi. W.*; “Combustion-driven synthesis route for tunable TiO₂/RuO₂ hybrid composites as high-performance electrode materials for supercapacitors”, **Chemical Engineering Journal**, **2020**, 384, 123269. <https://doi.org/10.1016/j.cej.2019.123269>
- [23] **Seo. B.S.**‡; Cha. Y.S.‡; Kim. S.T.*; Choi. W.*; “Rational Design for Optimizing Hybrid Thermo-Triboelectric Generators Targeting Human Activities”, **ACS Energy Letters**, **2019**, 4 (9), 2069-2074, *Selected as cover*. <https://doi.org/10.1021/acsenerylett.9b01426>
- [24] **Seo. B.S.**‡; Hwang. H.Y.; Park. S.H.; Choi. W.*; “A Simple Fabrication Route of Porous Palladium/Palladium Oxide/Carbon Nanostructures using One-Step Combustion Waves for High-Performance pH Sensors”, **Sensors and Actuators B: Chemical**, **2018**, 274, 37-46. <https://doi.org/10.1016/j.snb.2018.07.142>
- [25] **Seo. B.S.**‡; Hwang. H.Y.; Kang. S.G.; Cha. Y.S.; Choi. W.*; “Flexible-detachable dual-output sensors of fluid temperature and dynamics based on structural design of thermoelectric materials”, **Nano Energy**, **2018**, 50, 733-743. <https://doi.org/10.1016/j.nanoen.2018.06.027>
- [26] Yeo. T.H.‡; Shin. D.J.; Shin. J.H.; Hwang. H.Y.; **Seo. B.S.**; Lee. J.H.; Choi. W.*; “DC-field-driven combustion wave for one-step fabrication of reduced manganese oxide/multi-walled carbon nanotube hybrid nanostructures as high-performance supercapacitor electrodes”, **Journal of Materials Chemistry A**, **2017**, 5 (47), 24707-24719. <https://doi.org/10.1039/C7TA07812A>
- [27] Yeo. T.H.‡; Hwang. H.Y.; Shin. D.J.; **Seo. B.S.**; Choi. W.*; “Thermoelectric-Pyroelectric Hybrid Energy Generation from Thermopower Waves in Core-Shell Structured Carbon Nanotube-PZT Nanocomposites”, **Nanotechnology**, **2017**, 28 (6), 065403. <https://doi.org/10.1088/1361-6528/aa5277>
- [28] Shin. D.J.‡; Hwang. H.Y.; Yeo. T.H.; **Seo. B.S.**; Choi. W.*; “Thermopower Wave-driven Hybrid Supercapacitor Charging System”, **ACS Applied Materials & Interfaces**, **2016**, 8 (45), 31042-31050. <https://doi.org/10.1021/acsami.6b11334>

Patents

- [1] "COMPOSITE IN WHICH DEFECT-INDUCED CARBON BODY AND METAL OXIDE ARE BONDED, METHOD FOR MANUFACTURING THE SAME, AND BONDED ENERGY STORAGE DEVICE INCLUDING ELECTRODE AS THE SAME", **12.04.2023.**, 10-2611344 (**Republic of Korea**)
- [2] "Humidity-responsive energy harvester and its manufacturing method", **11.15.2023.**, 18/560,994 (**USA**)
- [3] "MANUFACTURING METHOD OF TRANSITION METAL OXIDE-BASED BINDER-FREE ELECTRODE FOR LITHIUM-ION BATTERIES", **09.27.2023.**, 18/373,437 (**USA**)
- [4] "TEMPERATURE MEASURING DEVICE", **01.05.2023.**, PCT/KR2023/000231 (**PCT**)
- [5] "Humidity-responsive energy harvester and its manufacturing method", **12.23.2022.**, 10-2482084 (**Republic of Korea**)
- [6] "COMPOSITE IN WHICH DEFECT-INDUCED CARBON BODY AND METAL OXIDE ARE BONDED, METHOD FOR MANUFACTURING THE SAME, AND BONDED ENERGY STORAGE DEVICE INCLUDING ELECTRODE AS THE SAME", **11.21.2022.**, PCT/KR2022/018396 (**PCT**)
- [7] "MANUFACTURING METHOD OF TRANSITION METAL OXIDE-BASED BINDER-FREE ELECTRODE FOR LITHIUM-ION BATTERIES", **11.08.2022.**, 10-2022-0147931 (**Republic of Korea**)
- [8] "Tactile sensor using triboelectric field propagation and tactile sensing method using the same", **09.30.2022.**, PCT/KR2022/014787 (**PCT**)
- [9] "Tactile sensor using triboelectric field propagation and tactile sensing method using the same", **09.29.2022.**, 10-2022-0123946 (**Republic of Korea**)
- [10] "FLEXIBLE TEMPERATURE–FLOW VELOCITY DUAL-PARAMETER SENSORS", **04.12.2022.**, 11,300,433 (**USA**)
- [11] "TEMPERATURE MEASURING DEVICE", **01.18.2022.**, 10-2022-0007293 (**Republic of Korea**)
- [12] "Humidity-responsive energy harvester and its manufacturing method", **12.01.2021.**, PCT/KR2021/017991 (**PCT**)
- [13] "A Fabrication Method of Combustion Waves Based Palladium Oxides Composites And A Fabrication Method of pH Sensor", **04.22.2020.**, 10-2105763 (**Republic of Korea**)
- [14] "Flexible sensors", **07.05.2019.**, 10-1999456 (**Republic of Korea**)

Conferences (selected)

- [1] "Development of energy harvesting and converting cells using ultrafast thermal processing", **Korean Society of Mechanical Engineers, 2023**, Spring meeting.
- [2] "Hybrid Energy Harvester Utilizing Dual Stimulus of Temperature and Humidity Enabled by Thermoelectric and Hydrons", **Materials Research Society, 2022**, Spring meeting.

[3] "Chemical and Phase Design of Pd/Pd_xO_y Composites Using Joule-heating of Carbon Materials for Humidity driven Energy Harvester", **Korean Society of Mechanical Engineers, 2021**, Spring meeting.

[4] "A Hybrid Thermo-Triboelectric Generator Optimized to Human Activities Timescales", **Materials Research Society, 2019**, Fall meeting.

[5] "Thermo-triboelectric dual-energy harvesting using human touch for optimization of power generation", **Korean Society of Mechanical Engineers, 2019**, Spring meeting.

[6] "A facile-thermal process via one-step combustion waves as a simple route to fabrication of Pd/Pd_xO_y@C nanostructures for high-performance pH sensor", **Korean Society of Mechanical Engineers, 2018**, Spring meeting.

[7] "Flexible temperature-flow rate dual-parameter fluid sensors using geometric design of thermoelectric materials on PET substrate", **Korean Society of Mechanical Engineers, 2017**, Spring meeting.

[8] "Maskless Patterning of CVD grown Vertically Aligned Carbon Nanotube Using Mechanical Scratch on Substrates", **Nanotube Conference, 2016**, Spring Meeting.