Seung-Yong Lee (이승용), Ph.D.

Division of Materials Science and Engineering, Hanyang University
222 Wangsimni-ro, Bldg.204 Room #433, Seongdong-gu, Seoul 04763, Republic of Korea
+82-10-3396-1144; syonglee@hanyang.ac.kr; syasms07@gmail.com

RESEARCH INTERESTS

***In-situ/operando* Reaction Mechanism Studies of Energy/Electronic Materials at Nano- to Atomic-scale**

My work seeks to elucidate reaction mechanisms of energy/electronic materials at nano to atomic scales with the state-of-the-art *in-situ/operando* transmission electron microscopy (TEM). This study involves inventing new types of *in-situ/operando TEM techniques* to develop an unprecedented level of robust microscopic temporal analysis systems for energy/electronic devices under their operating environment.

PROFESSIONAL APPOINTMENTS

2021.03 – **Assistant Professor**
Division of Materials Science and Engineering, Department of Chemical Engineering (Join Appointment), **Hanyang University**

EDUCATION & RESEARCH EXPERIENCE

2018 – 2020 **Postdoctoral Scholar**
Materials Science Division, **Lawrence Berkeley National Laboratory, U.S.A.**
Advisor: Haimei Zheng, Senior Staff Scientist (LBNL) & Adjunct Professor (UC Berkeley)

2017 – 2018 **Postdoctoral Scholar**
(Technical Research Personnel as Alternative Military Service of Korea; 전문연구요원)
Research Institute of Advanced Materials, **Seoul National University**
Advisor: Miyoung Kim, Professor of Materials Science and Engineering

2016 Visiting Scholar
Condensed Matter Physics & Materials Science, Brookhaven National Laboratory, U.S.A.
Advisor: Yimei Zhu, Senior Scientist (BNL) & Adjunct Professor (Columbia Univ. / Stony Brook Univ.)

2012 – 2017 **Ph.D. in Materials Science and Engineering, Seoul National University**
Advisor: Miyoung Kim, Professor of Materials Science and Engineering
Dissertation: Investigation on electrochemical reaction mechanisms of lithium-ion battery electrode materials by transmission electron microscopy

2007 – 2012 **Bachelor of Science in Materials Science and Engineering,**
Bachelor of Business Administration (Joint Honors), Seoul National University
Graduated with Honors: *Summa cum laude*
Fellowships: National Scholarship for Natural Sciences and Engineering

PUBLICATIONS

1 H. –G. Liao† and **S. –Y. Lee† (Co-First)**, Y. A. Wu, Y. Dai, Y. Ye, X. Zhang, Z. Zeng, K. Bustillo, J. Guo, J. Warner, V. Srinivasan, and H. Zheng*, Lithium polysulfide phase transition of Li-S batteries investigated by liquid phase electron microscopy and x-ray absorption spectroscopy, *in preparation*.

2 G. Li*, **S. –Y. Lee**, W. Li, X. Zhou, Y. Hu, H. Oh, J. Park, M. Kim, and G. –C. Yi, Synthesis and

Electrochemical Properties of N-doped α-MoO_3 Nanobelts, *Under Peer Review*.

3 J. Oh, **S. –Y. Lee**, H. Kim, J. Ryu, B. Gil, J. Lee, and M. Kim*, Overcharge-Induced Phase Heterogeneity and Resultant Twin-Like Layer Deformation in Lithium Cobalt Oxide Cathode for Lithium-Ion Batteries, ***Advanced Science***, 2203639 (2022)

4 S. Yoon, H. Seo, K. Jin, H. G. Kim, **S. –Y. Lee**, J. Jo, K. H. Cho, J. Ryu, A. Yoon, Y. -W. Kim, J. -M. Zuo, Y. -K. Kwon, K. T. Nam, and M. Kim*, Atomic reconstruction and oxygen evolution reaction of Mn3O4 nanoparticles, ***The Journal of Physical Chemistry Letters*** 13, 8336-8343 (2022)

5 **S. -Y. Lee**, J. Shangguan, S. Betzler, S. J. Harris, M. M. Doeff, and H. Zheng*, Lithium metal stripping mechanisms revealed through electrochemical liquid cell electron microscopy, ***Nano Energy*** 102, 107641 (2022)

6 **S. –Y. Lee**, J. Shangguan, J. Alvarado, S. Betzler, S. J. Harris, M. M. Doeff, and H. Zheng*, Unveiling the mechanisms of lithium dendrite suppression by cationic polymer film induced solid-electrolyte interphase modification, ***Energy & Environmental Science*** 13, 1832 *(2020) (IF: 33.250; JCR2018)*

7 B. Qiu, M. Zheng, **S. –Y. Lee**, H. Liu, T. A. Wynn, L. Wu, Y. Zhu, W. Wen, C. M. Brown, D. Zhou, Z. Liu*, Y. S. Meng*, Metastability and reversibility of anionic redox-based cathode for high-energy rechargeable batteries, ***Cell Reports Physical Science*** 1, 100028 (2020)

8 Z. Zeng, P. Barai, **S. –Y. Lee**, J. Yang, X. Zhang, W. Zheng, Y. –S. Liu, K. C. Bustillo, P. Ercius, J. Guo, Y. Cui*, V. Srinivasan, H. Zheng*, Electrode roughness dependent electrodeposition of sodium at the nanoscale, ***Nano Energy*** 72, 104721 (2020)

9 J. Kim†, G. Y. Kim†, T. T. T. Nguyen, S. Yoon, Y. -K. Kim, **S. -Y. Lee**, M. Kim, D. -H. Cho, Y. -D. Chung, J. -H. Lee, M. -J. Seong, and W. Jo*, "Sodium-assisted passivation of grain boundaries and defects in $Cu_2ZnSnSe_4$ thin films", ***Physical Chemistry Chemical Physics*** 22, 7597 (2020)

10 D. –H. Nam, J. –Y. Kim, S. Kang, W. Joo, **S. –Y. Lee**, H. Seo, H. G. Kim, I. –K. Ahn, G. –B. Lee, M. Choi, E. Cho, M. Kim, K. T. Nam, S. Han, and Y. –C. Joo*, Anion extraction-induced polymorph control of transition metal dichalcogenides, ***Nano Letters*** 19, 12, 8644 (2019)

11 **S. -Y. Lee**, L. M. Housel, J. Huang, L. Wu, E. S. Takeuchi, A. C. Marschilok, K. J. Takeuchi*, M. Kim*, and Y. Zhu*, Inhomogeneous structural evolution of silver-containing alpha-MnO_2 nanorods in sodium-ion batteries investigated by comparative transmission electron microscopy approach, ***Journal of Power Sources*** 435, 226779 (2019)

12 S. –M. Lim†, H. –W. Yeon†, G. –B. Lee, M. –G. Jin, **S. –Y. Lee**, J. Jo, M. Kim, and Y. –C. Joo*, Thermally stable amorphous oxide-based schottky diodes through oxygen vacancy control at metal/oxide interfaces, ***Scientific Reports*** 9, 7872 (2019)

13 J. Choi† and **S. –Y. Lee† (Co-First)**, S. Yoon, K. –H. Kim, M. Kim, and S. –H. Hong*, The role of Zr doping in $Li[Ni_{0.6}Co_{0.2}Mn_{0.2}]O_2$ as a stable cathode material for lithium ion batteries, ***ChemSusChem*** 12, 2439 (2019)

14 D. -H. Kwon, S. Lee, C. S. Kang, Y. S. Choi, S. J. Kang, H. L. Cho, W. Sohn, J. Jo, **S. –Y. Lee**, K. H. Oh, T. W. Noh, R. A. De Souza, M. Martin*, and M. Kim*, Unraveling the origin and mechanism of nano-filament formation in polycrystalline $SrTiO_3$ resistive switching memories, ***Advanced Materials*** 31, 28, 1901322 (2019)

15 **S. –Y. Lee**, G. –S. Park*, C. Jung, D. –S. Ko, S. –Y. Park, H. G. Kim, S. –H. Hong, Y. Zhu*, and M. Kim*, Revisiting primary particles in layered lithium transition-metal oxides and their impact on structural degradation, ***Advanced Science*** 6, 6, 1800843 (2019)

16 S. B. Lee*, **S. –Y. Lee**, S. J. Yoo, Y. Kim, J. –G. Kim, M. Kim, and H. N. Han, Roughening and strain-field evolution at a coherent grain boundary in α-Al_2O_3, ***Physical Review Materials*** 2, 113405 (2018)

17 J. Jang† and **S. –Y. Lee† (Co-First)**, H. Park, S. Yoon, G. –S. Park, G. –D. Lee, Y. Park, M. Kim*, and E. Yoon*, Solid-phase epitaxial growth of an alumina layer having a stacking-mismatched domain structure of the intermediate γ-phase, ***ACS Applied Materials & Interfaces*** 10, 48, 41487 (2018)

18 K. Baek, **S. –Y. Lee**, S. –G. Doh, M. Kim, and J. K. Hyun*, Axial oxygen vacancy-regulated microwave absorption in micron-sized tetragonal $BaTiO_3$ particles, ***Journal of Materials Chemistry C*** 6, 9749 (2018)

19 P. Smith, A. Brady, **S. –Y. Lee**, A. Bruck, E. Dooryhee, L. Wu, Y. Zhu, K. J. Takeuchi, E. S. Takeuchi, A. C. Marschilok, Deliberately designed atomic-level silver containing interface results in improved rate capability and utilization of silver hollandite for lithium-ion storage, ***ACS Applied Materials & Interfaces*** 10, 1, 400 (2018)

20 S. B. Lee*, **S. –Y. Lee**, M. Kim, and H. N. Han, Increased mobility of an a-Al_2O_3 grain boundary by electron-beam irradiation, ***Journal of Materials Science*** 53, 4, 2383 (2018).

21 **S. –Y. Lee**, L. Wu, A. S. Poyraz, J. Huang, A. C. Marschilok, K. J. Takeuchi, E. S. Takeuchi*, M. Kim*, and Y. Zhu*, Lithiation mechanism of tunnel-structured MnO2 electrode investigated by in situ transmission electron microscopy, ***Advanced Materials*** 29, 43, 1703186 (2017)

22 Y. –H. Oh, S. –I. Kim, M. Kim, **S. –Y. Lee* (Corresponding)**, and Y. –W. Kim*, Preferred diffusion paths for copper electromigration by *in situ* transmission electron microscopy, ***Ultramicroscopy*** 181, 160 (2017)

23 H. –W. Yeon, J. Jo, H. Song, Y. Kang, S. Na, H. Yoo, **S. –Y. Lee**, H. Cho, H. –Y. Kang, J. –K. Jung, S. Han, M. Kim, and Y. –C. Joo*, Cu diffusion-driven dynamic modulation of the electrical properties of amorphous oxide semiconductors, ***Advanced Functional Materials*** 27, 25, 1700336 (2017)

24 B. Zhang, P. F. Smith, **S. –Y. Lee**, L. Wu, Y. Zhu, E. S. Takeuchi*, A. C. Marschilok*, and K. J. Takeuchi*, Tailoring the Ag^+ content within the tunnels and on the exposed surfaces of α-MnO_2 nanowires: impact on impedance and electrochemistry, ***Journal of The Electrochemical Society*** 164, 1, A6163 (2017)

25 G. Y. Kim, J. Yang, T. T. T. Nguyen, S. Yoon, J. Nam, D. Lee, D. Kim, M. Kwon, C. –W. Jeon, Y. –K. Kim, **S. –Y. Lee**, M. Kim, and W. Jo*, High photo-conversion efficiency in double-graded $Cu(In,Ga)(S,Se)_2$ thin film solar cells with two-step sulfurization post-treatment, ***Progress in Photovoltaics*** 25, 2, 139 (2017)

26 J. Huang, A. S. Poyraz, **S. –Y. Lee**, L. Wu, Y. Zhu, A. C. Marschilok*, K. J. Takeuchi*, and E. S. Takeuchi*, Silver-containing α-MnO_2 nanorods: electrochemistry in Na-based battery systems, ***ACS Applied Materials & Interfaces*** 9, 5, 4333 (2017)

27 **S. –Y. Lee**, K. –Y. Park, W. –S. Kim, S. Yoon, S. –H. Hong, K. Kang, and M. Kim*, Unveiling origin of additional capacity of SnO_2 anode in lithium-ion batteries by realistic *ex situ* TEM analysis, ***Nano Energy*** 19, 234 (2016)

TEACHING EXPERIENCE

Lecturer

- Nanomaterials Characterization/나노소재기기분석 (Undergraduate), Hanyang University (2021-1)
- Materials Science 2/재료과학 2 (Undergraduate), Hanyang University (2021-2)
- Career Development II/커리어개발 II (Undergraduate), Hanyang University (2021-2)
- Advanced Electrochemistry/재료전기화학특론 (Graduate), Hanyang University (2021-2)

Teaching Assistant

Responsibilities including giving lectures, grading assignments and exams, and advising students:

- C language programming class (Undergraduate), Fall, Seoul National University (2012)
  : lectured to ~60 undergraduate students for 2 hours every other weeks
- Calculus class (Undergraduate), Spring, Seoul National University (2010)
  : lectured to 8 undergraduate students for 3 hours every week

Research Assistant

- Transmission Electron Microscope Manager and Instructor, Lawrence Berkeley National Laboratory (2018–)
  : trained new facility users to experiment properly
- Scanning Electron Microscope Research Assistant, National Center for Inter-University Research Facilities, Seoul National University (2014)
  : assisted an equipment experience program for 28 undergraduate students
- Self-design Experiments in Materials class (Undergraduate), Fall, Seoul National University (2012)
  : assisted researches for a designated undergraduate student

Mentoring Activities

- Campus Mentoring Program Mentor for University Freshmen, Seoul National University (2010, 2011)
  : helped and coached 4 university freshmen during their first semester

AWARDS & FELLOWSHIPS

Director's Award for Exceptional Safety Achievement, Lawrence Berkeley National Laboratory (2019)

Samsung HumanTech Paper Award: Silver Prize, Samsung (2017)

Best Presentation Award, The 11th University of Tokyo (UT) – Seoul National University (SNU) – Tsinghua University (TU) Student Workshop (2015)

Best Poster Presentation Award, 2015 Materials Fair, Seoul National University (2015)

Samsung HumanTech Paper Award: Bronze Prize, Samsung (2015)

Academic Excellence Scholarship, Seoul National University (2013)

Graduation Award for Excellent Grade, Engineering Alumni Association of Seoul National University (2012)

Graduation with honors: *summa cum laude*, Seoul National University (2012)

National Scholarship for Natural Sciences and Engineering, Korea Student Aid Foundation (2007–2010)