Sangmin Lee

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Education

University of Michigan, Ann Arbor, MI, USA — Sep 2015 – Apr 2021
Ph. D. in Chemical Engineering - *Advisor: Prof. Sharon Glotzer*

Hanyang University, Seoul, Korea — Sep 2013 – Aug 2015
M.S. in Chemical Engineering - *Thesis Advisor: Prof. Young Chan Bae*

Hanyang University, Seoul, Korea — Mar 2007 – Aug 2013
B.S. in Chemical Engineering

Research Experience

Assistant Professor
Department of Chemical Engineering, Pohang University of Science and Technology (POSTECH), Pohang, South Korea — Jan 2024 – present

Postdoctoral Scholar
Howard Hughes Medical Institute, Seattle, WA (PI: *Prof. David Baker*) — Sep 2022 – Dec 2023
University of Washington, Seattle, WA (PI: *Prof. David Baker*) — Feb 2021 – Sep 2022

Research Interest

Protein design
- Computational design of pseudo-symmetric protein oligomers and nanocages using physics based (Rosetta software) and deep learning based (ProteinMPNN, AlphaFold) software
- Experimental validations and characterizations of designed proteins

Self-assembly and phase behavior of bio-inspired nanomaterials
- Computational modeling of DNA-functionalized nanoparticles (paper1, paper2, paper3, paper4)
- Simulation study of self-assembly of polyhedral nanoparticles (paper1, paper2, paper3)
- Molecular dynamics simulation, Monte Carlo simulation (Python, C++) (paper1)

Publications (*Equal contribution, †Corresponding author)

---------- *Preprints* ----------

19. **S. Lee**[*], R. D. Kibler[*], Y. Hsia, A. Borst, A. Philomin, M. A. Kennedy, B. Stoddard, D. Baker[†], "Design of four component T=4 tetrahedral, octahedral, and icosahedral protein nanocages through programmed symmetry breaking", *bioRxiv* (2023) (in revision @ *Nature*)

18. R. D. Kibler, **S. Lee**, M. A. Kennedy, B. Stoddard, B. I. M. Wicky, C. M. Chow, L. Carter, D. Baker[†], "Stepwise design of pseudosymmetric protein hetero-oligomers", *bioRxiv* (2023) (in revision @ *Nature Communication*)

---------- *Published* ----------

17. R. Mout[*], R. C. Bretherton[*], N. I. Edman, **S. Lee**, J. Decarreau, M. Ahlrichs, Y. Hsia, D. D. Sahtoe, G. Ueda, R. Schulman, C. A. DeForest[†], D. Baker[†], "De novo design of modular protein hydrogels with programmable intra- and extracellular viscoelasticity", *PNAS* (2024)

16. W. Zhou[*], Y. Lim[*], H. Lin[*], **S. Lee**[*], Y. Li, Z. Huang, J. S. Du, S. Wang, A. Sánchez-Iglesias, M. Grzelczak, L. M. Liz-Marzán[†], S. C. Glotzer[†] and C. A. Mirkin[†] "Colloidal Quasicrystal Engineered with DNA", *Nature Materials* (2023)

15. **S. Lee**, T. Vo, and S. C. Glotzer[†], "Entropic compartmentalization produces open host-guest colloidal clathrates", *Nature Chemistry* (2023)

14. Y. Lim, **S. Lee**, and S. C. Glotzer[†], "Entropy-driven enantiotropic and monotropic mesophase transitions in colloidal bipyramids", *ACS Nano* (2023)

13. **S. Lee** and S. C. Glotzer[†], "Entropically Engineered Formation of Fivefold and Icosahedral Twin Clusters of Colloidal Shapes", *Nature Communications* (2022)

12. S. Lee[*], H. A. Calcaterra[*], **S. Lee**[*], W. Hadibrata, B. Lee, E. B. Oh, K. Aydin, S. C. Glotzer and C. A. Mirkin[†], "Shape-memory in self-adapting colloidal crystals", *Nature* (2022)

11. S. Wang[*], **S. Lee**[*], J. S. Du*, B. Patridge, W. Zhou, V. P. David, B. Lee[†], S. C. Glotzer[†] and C. A. Mirkin[†], "The emergence of valency in colloidal crystals through electron equivalents", *Nature Materials* (2022)

10. M. Klement, **S. Lee**, J. A. Anderson and M. Engel[†], "Newtonian Event-Chain Monte Carlo and Collison Prediction with Polyhedral Particles", *Journal of Chemical Theory and Computation* *17, 4686-4696* (2021)

9. K. Je, **S. Lee** E. G. Teich, M. Engel[†] and S. C. Glotzer[†], "Entropic error-and-repair formation mechanism of a quasicrystal", *PNAS* *118* (2021)

8. J. S. Oh, **S. Lee**, S. C. Glotzer[†], G. Yi[†] and D. J. Pine[†], "Colloidal fibers and rings by cooperative assembly", *Nature Communications* *10, 3936* (2019)

7. **S. Lee**, E. G. Teich, M. Engel[†] and S. C. Glotzer[†], "Entropic colloidal crystallization pathways via fluid–fluid transitions and multidimensional prenucleation motifs", *PNAS* *116, 14843-14851* (2019)

6. H. Lin*, **S. Lee***, L. Sun, M. Spellings, M. Engel, S. C. Glotzer† and C. A. Mirkin†, "Clathrate Colloidal Crystals", *Science* 355, 931-935 (2017)

5. **S. Lee** and Y. C. Bae†, "Cosolvency Effect on Tunable Thermosensitive Core-shell Nanoparticle Gels", *Soft Matter* 11, 3936-3945 (2015)

4. **S. Lee** and Y. C. Bae†, "Swelling Behaviors of Doubly Thermosensitive Core-shell Nanoparticle Gels", *Macromolecules* 47, 8394-8403 (2014)

3. **S. Lee**, J. H. Lee, and Y. C. Bae†, "Swelling Behaviors of Poly(methyl methacrylate) Nano-sized Gels in PEG/Alcohol Solutions", *Fluid Phase Equilibria* 382, 107-115 (2014)

2. **S. Lee** and Y. C. Bae†, "Enhanced Solvation Effect on Re-collapsing Behavior for Cross-linked PMMA Particle Gel in Aqueous Alcohol Solutions", *Polymer* 55, 4684-4692 (2014)

1. S. M. Kim, **S. Lee**, and Y. C. Bae†, "Influence of hydroxyl group for thermoresponsive poly(N-isopropylacrylamide) gel particles in water/co-solvent (1,3-propanediol, glycerol) systems", *European Polymer Journal* 54, 151-159 (2014)

Research Skills

- Coding proficiencies: Python (Advanced), C++ (intermediate), Mathematica (intermediate), git, bash scripting, XML, MatPlotLib, NumPy, SciPy, LaTex

- Monte Carlo and molecular dynamics simulations (HOOMD-Blue package)

- *de novo* protein sequence design using Rosetta software, ProteinMPNN and AlphaFold

- Protein synthesis via *E. coli* expression using synthetic genes

- Independent operation of negative-stain electron microscope

- Protein characterization via size-exclusion chromatography, gel electrophoresis and dynamic light scattering

Teaching and Mentoring Experiences

- Currently, I am receiving a teaching training program, Science Teaching Experience Program (STEP), provided by the University of Washington. With a guidance of a mentor, I am designing a 2-credit undergraduate course that I will teach in the following spring term.

- Graduate Student Instructor for ChE538, a graduate level thermodynamic class of ChE at University of Michigan (2018)

- Teaching Assistant for ChE3005, an undergraduate level thermodynamic class of ChE at Hanyang University (2014)

- Multiple experiences of peer mentoring and academic support for PhD students