

# Seonggyun Kim

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## SUMMARY

Chemical engineering graduate passionate about industry decarbonization and sustainable energy solutions. Experienced in process simulation, numerical modelling, and techno-economic analysis, with hands-on research expertise in carbon capture processes and hydrogen economy. Strong background in process optimization, energy storage, and industrial-scale applications of low-carbon technologies.

## EDUCATION

### KTH Royal Institute of Technology

Dec. 2025

*M.Sc., Chemical Engineering for Energy and Environment*

*Stockholm, Sweden*

- Thesis: Dynamic reactor modeling and operational optimization of flexible e-methanol production.
- Fields of interest: Industrial energy processes, combined heat and power, process modelling and optimization, energy storage and conversion, industry decarbonization, carbon capture, and utilization.

### Hanyang University

Feb. 2023

*B.S., Chemical Engineering*

*Seoul, South Korea*

- Thesis: Simulation and optimization of MDEA-based CO<sub>2</sub> capture process using Aspen HYSYS.
- Fields of interest: Thermodynamics, Reaction engineering, Process optimization.

### Nanyang Technological University

Jul. 2018

*Summer Exchange Program*

*Singapore*

- Completed "Introduction to Energy" course.

## WORK EXPERIENCE

### AVEVA

Sep. 2024 – Nov. 2024

*Process Simulation Intern | Solver/Thermo Team, R&D Aveva Process Simulation*

*Lake Forest, California (Remote)*

- Expanded the thermodynamic database for AVEVA Process Simulation, enhancing industry adoption of advanced carbon capture technologies (Benfield process, AMP-PZ solvent).
  - Developed electrolyte-NRTL fluid/reaction models for K<sub>2</sub>CO<sub>3</sub>-CO<sub>2</sub>-H<sub>2</sub>O and AMP-PZ-CO<sub>2</sub>-H<sub>2</sub>O systems.
  - Conducted thermophysical property regression using Python scripts to align with experimental data.
- Built process simulation files for headless testing and prepared technical documents on carbon capture processes.

### Fraunhofer UMSICHT

Sep. 2022 – Feb. 2023

*Research Assistant | Department of Low Carbon Technologies*

*Oberhausen, Germany*

- "Ammonia to Hydrogen" project: a system-level analysis of ammonia decomposition process for hydrogen production.
  - Designed and optimized an Aspen PLUS process simulation for ammonia-to-hydrogen scenarios with techno-economic evaluation.
  - Assembled and tested an electrically heated fixed-bed reactor for ammonia decomposition, optimizing temperature profiles based on activated carbon packing.

## ACADEMIC PROJECTS

### Techno-economic Analysis of CCUS in Sweden

Dec. 2024

- Modeled MEA-based carbon capture and CO<sub>2</sub> hydrogenation processes using Aspen Plus V14.
- Evaluated economic feasibility for storage and utilization scenarios in Sweden's cement (Slite) and pulp (Korsnäs) industries.
- Led methanol production process design, optimizing kinetic models and reporting levelized costs for breakeven analysis.

### AVEVA Process Simulation Academic Competition 2024 - Hydrogen Economy

Feb. 2024

- Designed a green ammonia synthesis process integrating solar hydrogen production in AVEVA Process Simulation.
- Optimized heat integration using high- and low-pressure steam, comparing EAOC and NPV against pipeline transport.
- The simulation and technical report entries in the three-part project won "Best Overall" prize in Europe.

### **Metal Recovery Using Supercritical CO<sub>2</sub>**

**Feb. 2024**

- Investigated scCO<sub>2</sub> extraction for recovering rare earth elements and heavy metals from coal fly ash, ores, and batteries.
- Demonstrated industrial potential with recovery rates up to 97% for uranium and 90% for rare earth elements.
- Assessed the technology readiness level (TRL 4) and selectivity challenges for industrial implementation.

### **Nickel-rich Electrodes for Li-ion Batteries**

**Dec. 2023**

- Reviewed Ni-rich electrodes for lithium-ion batteries, highlighting their structural configurations, degradation mechanisms, and commercial applications.
- Identified performance limitations and degradation during cycling, and challenges in finding suitable electrolytes.
- Addressed the need to replace cobalt in existing electrodes and the overall impact on the commercial viability of Ni-rich materials.

### **Pressurized Pilot-scale Fluidized Bed Gasifier: A Risk Analysis**

**Dec. 2023**

- Conducted a Preliminary Hazard Analysis (PHA) and What-if analysis on an existing gasification plant at KTH.
- Provided risk assessments and recommendations for process safety enhancements.

### **Thermodynamic Analysis of a Biomass-fueled Combined Heat and Power Plant with a Fuel Drier**

**Oct. 2023**

- Thermodynamic analysis of the system components (compressors, turbines, heat exchangers, and a drier).
- Presented graphical results from pinch analysis and heat exchange calculations.
- Economic analysis based on different scenarios varying electricity, fuel, and green certificate prices.

### **Simulation and Optimization of MDEA-based CO<sub>2</sub> Capture Process**

**Jun. 2022**

- Developed Aspen HYSYS simulations for process optimization and sensitivity analysis.
- Verified the relationship between absorber L/G ratio, CO<sub>2</sub> recovery, lean loading, and specific reboiler duty.

### **NRTL Parameter Optimization for Alkane/Sulfolane Binary Mixtures**

**Nov. 2021**

- Optimized NRTL parameters to accurately calculate liquid-liquid equilibria using MATLAB.
- Achieved improved accuracy by adding a linear term to the  $\tau$  term in the conventional model.

### **Estimation of Energy Penalty in Post-Combustion CCS**

**Jun. 2021**

- Estimated energy consumption of CO<sub>2</sub> compression and refrigeration using Lee-Kesler equation of state programmed in MATLAB.
- Optimized compression processes for high-pressure storage and low-pressure transport pathways.

### **Eigenfaces: Face Recognition Machine Learning Algorithm**

**Dec. 2020**

- Developed a face recognition machine learning algorithm in MATLAB using PCA and SVD.
- Trained on Yale\_B dataset and successfully identified faces outside the training set.
- Applied dimensionality reduction and pattern recognition techniques for real-world image data. Built a face image recognition algorithm using MATLAB.

## **COMPUTER SKILLS**

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- **Programming:** MATLAB, Python, Fortran, MS Excel VBA (Intermediate level); MS Visual C++, C (Basic level)
- **Application:** AVEVA Process Simulation, Aspen HYSYS, Aspen PLUS, COMSOL; MS Office

## **LANGUAGES**

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- Korean: Native
- English: Proficient
- Swedish: Beginner

## **OTHER**

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- Hobbies: Jazz performance/composition, Linux ricing