

# MINGI KANG

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## RESEARCH INTEREST

My research interests focus on understanding chemical phenomena at the microscopic level through computational chemistry methodologies and accelerating these investigations using AI. Based on this fundamental understanding, I aim to explore and design novel materials and catalysts.

## SKILLS

### Computational Chemistry

- Ab initio calculation: Psi4, PySCF, GAMESS-US, Gaussian, ORCA, CP2K etc.
- Molecular Dynamics: OpenMM, ASE
- Modeling & Simulation: scikit-learn, pytorch, Training ML potentials

### Scientific Skills

- Job scripting & submission in HPC server (PBS, SGE) via SSH
- Dataset construction & handling (HDF5, SQL)
- Data visualization

### Development Skills

- Workflow automation
- Python packaging & deployment
- Git, Cloud service, API

## RESEARCH EXPERIENCE

### Bachelor's Thesis

Lab of Ultrafast Spectroscopy, Korea University (Sejong)

March 2025 - Present

Prof. Jae Yoon Shin

- Investigated kinetic behavior of ionic liquids in porous filters (Polyethersulfone and Anodisc)
- Performed molecular dynamics calculations using force fields and fine-tuned ML potentials
- Built simulation systems and analyzed dynamic trajectories to determine diffusion coefficients

### CURT Research Program

Laboratory of Inorganic Chemistry, Korea University (Sejong)

July 2025 - Present

Prof. Ho-Jin Son

- Studied reaction mechanisms of homogeneous transition metal catalysts using DFT and MLP methods
- Computed Gibbs energy profiles through various levels of DFT
- Developed automated job submission scripts and established workflows for Gibbs energy profile calculation

### Winter Internship

The Meta Lab, KENTECH

January 2025 - February 2025

Prof. Geun Ho Gu

- Fine-tuned universal MLP models for heterogeneous catalyst systems
- Reproduced surface adsorption energies using MLP and compared results with DFT

### Project Semester

Lab of Ultrafast Spectroscopy, Korea University (Sejong)

July 2024 - December 2024

Prof. Jae Yoon Shin

- Collected and preprocessed organic molecule dataset (10K samples) using the PubChem API
- Performed large-scale ab initio calculations (50K) and built normal mode perturbed molecular dataset
- Fine-tuned ANI Machine Learning Potentials (MLP) to improve accuracy in transition state regions
- Conducted MLP-based molecular dynamics simulations of carbon polymerizations and acetylene annulation reactions
- Developed Python package for MLP-based distortion interaction analysis calculations

### X-Corps Research Program

Biomedical Nano-engineering Lab, Korea University (Sejong)

November 2019 - April 2020

Prof. Gyudo Lee

- Developed paper-based colorimetric biosensor for ethanol concentration measurement and color quantification
- Synthesized polyaniline (PANI) nanoparticles and immobilized ADH on PANI-coated paper
- Proposed RGB color picker method for pH prediction and studied lighting brightness effect corrections

## EDUCATION

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**Korea University (Sejong)** | GPA: 4.12 / 4.5  
**B.S. in Advanced Material Chemistry**

March 2019 - Present

## PROJECTS

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### ASE Community Code Development

- Implemented ASE calculator interfaces for g-xTB, PySCF, MLatom, and XequiNet
- Developed optimizer wrappers for asemd and geomeTRIC to enhance integration of ASE-centered workflows

### Distortion Interaction Analysis

- Implemented ASE interfaces for distortion interaction analysis calculations
- Enabled flexible computations and streamlined computational workflows

### randatoms

- Developed a molecular filtering package using pickle-based metadata caching
- Used indexed HDF5 storage to enable fast random access and optimize I/O performance for large-scale molecular datasets

### Molecular Visualizer

- Developing molecular visualization tools including ASE-native viewer aseview and OverlayMol
- Supports visualization of molecular normal modes, overlay diagrams, and animations with publication-ready quality

### Image to Music Recommendation Service

June 2024

- Proposed the project topic and managed its scheduling, planning, and overall design
- Collected various types of data using APIs and web crawling, and performed data preprocessing
- Designed the service architecture, developed, and deployed the website using Streamlit

### Deepfake Voice Detection

Sep 2024 - May 2025

- Proposed a strategy for generating deepfake voice data
- Preprocessed audio data by adjusting sampling rates and converting file formats to wav
- Transformed audio data into Mel spectrogram for modeling

## SCHOLARSHIPS

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### Chi-Woo Lee Scholarship

- Korea University, 2025, KRW 5,000,000

### Academic Excellence Scholarship

- Korea University, 2025, KRW 2,350,000

## AWARDS & HONORS

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### Excellent Research Report Award

- S-CURT Research Program, Korea University, 2025

## RESEARCH GRANTS

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### Project Semester Research Grant

- Korea University, 2024, KRW 1,500,000

## ADDITIONAL ACTIVITY

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### Data Science Bootcamp

February 2023 - July 2023

- Completed a 6-month intensive course on data science and machine learning

## MILITARY SERVICE

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### Country's Army (Sergeant)

July 2022 - January 2024

- Completed mandatory military service.