Chengyu Zhou

KAUST, Thuwal, Jeddah, 23955-6900, Saudi Arabia
Email: chengyu.zhou@kaust.edu.sa Mobile: +966 054-978-6142

EDUCATION

KAUST, Clean Combustion Research Center (CCRC), Saudi Arabia 09/2021-Present
M.S. in Mechanical Engineering
Advisor: Prof. Aamir Farooq, Co-advisor: Prof. Mani Sarathy

Dalian University of Technology (DLUT), China 09/2017-06/2021
B.S. in Energy and Power Engineering
Advisor: Prof. Ming Jia

PUBLICATIONS

1. **C. Zhou**, J. Zou, S.S. Nagaraja, S.M. Sarathy, A. Farooq. Detailed experimental and kinetic modeling study of isoprene oxidation at high temperature. ***Combustion and Flame*** (in progress).
2. **C. Zhou**, D. Liu, A. Farooq. An investigation of 1-butene and 1-pentene thermal decomposition. ***Combustion and Flame*** (in revision).
3. H. Jin, **C. Zhou**, A. Farooq. C7 reaction mechanism and its self-imitation in the kinetic modeling of PAH formation. ***Combustion and Flame*** (in revision).
4. **C. Zhou**, Y. Chang, P. Wang, B. Niu, M. Jia. Construction of a skeletal oxidation mechanism for 2,5-dimethylfuran using decoupling methodology and reaction class-based global sensitivity analysis. ***Energy and Fuels***, 34 (2020), pp. 16654-16665.
5. Y. Chang, M. Jia, B. Niu, M. Xie, **C. Zhou.** Reduction of detailed chemical mechanisms using reaction class-based global sensitivity and path sensitivity analyses. ***Energy and Fuels***, 33 (2019), pp. 9289-9301.

RESEARCH

Experimental and kinetic modeling study of isoprene combustion 06/2022-Present

- To develop **the first detailed kinetic model for isoprene** oxidation at high temperature.
- Employed shock tubes and a rapid compression machine to measure the ignition delay times and a jet-stirred reactor to measure the species profiles at various temperatures and pressures.
- To combine the sensitivity analysis, rate of production and rate rules to construct the fuel sub-mechanism, and then couple the isoprene sub-mechnism with a core C0-C4 sub-mechanism.
- To use UV absorption diagnostics and shock tubes to measure the rate constants of the elementary reactions related to isoprene decomposition.

A study of rate constants for 1-butene and 1-pentene thermal decomposition 01/2022-05/2022

- This was **the first** high temperature kinetic study for the reactions of 1-butene and 1-pentene thermal decomposition coupling UV lasers and shock tubes over 1178–1416 K and 1.2 bar.

- Literature measurements over 1000 K overall agree well with our rate coefficients for both molecules.
- Our new rates generally improved previous models' performance when predicting major species concentrations, which indicates the reliability of our measured rates.

A study of rate constants for cyclohexene thermal decomposition 10/2021-11/2021

- UV laser diagnostics and shock tubes was used to measure the rate constants for the reaction of cyclohexene thermal decomposition over 1000 K and 1 bar.
- Our rate coefficients for cyclohexene have a satisfactory agreement with literature data over 1000 K.
- We recommend these new rate data to be implemented for the improvement of the oxidation model of C6-cyclic hydrocarbons.

Auto-generated reduced kinetic models for furan group fuels 09/2020-05/2021

- A detailed mechanism for 2-methylfuran is automatically simplified from 305 species and 1472 reactions to **48 species and 184 reactions using Python, C and Linux**.
- Model validation revealed that the present skeletal mechanisms could satisfactorily predict the ignition delay times, major species profiles, and laminar flame speeds for furan group fuels.
- The present method for the construction of skeletal mechanisms, i.e., RC-GSPSA, was capable of being extended to larger hydrocarbons.

Auto-generated reduced kinetic models for 2,5-dimethylfuran 07/2019-06/2020

- Combined the reaction class-based global sensitivity and path sensitivity analysis (RC-GSPSA) method and the decoupling methodology to get an initial reduced mechanism.
- Employed the genetic algorithm to automatically optimize the reduced mechanism's performance.
- A detailed mechanism for 2,5-dimethylfuran is automatically simplified from 545 species and 2768 reactions to **57 species and 212 reactions using Python, C and Linux**.

Python-based kinetic model reduction using reaction class analysis 07/2018-06/2019

- Applied reaction class to reduce the number of parameters for sensitivity analysis in reduction method.
- Utilized Morris method and path sensitivity analysis by python to recognize major reaction classes.
- Reaction class-based reduction can capture the coupling relationship between different reactions and reaction classes.

Engine performance in RCCI mode of n-butanol/biodiesel 03/2018-06/2018

- Proposed a new RCCI mode with direct injection of biodiesel in the cylinder and port injection of premixed n-butanol.
- Post-processed and analyzed the data about pressure, heat release rate and CO, CO_2, H_2O, NO_X.
- Percentage of biodiesel determines in-cylinder fuel reactivity and starting of injection influences reactivity distribution.

SKILLS AND ACADEMIC PERFORMANCE

- Automatic mechanism generation and reduction using Python, C/C++ and Linux
- Development of detailed chemical models based on experiments and kinetic modeling
- High-precision rate measurements for gas-phase reactions using laser diasgnostics and shock tubes

- Operation, alignment, and maintenance of lasers including Nd:YAG laser, Ti-Sapphire laser, etc
- Troubleshooting and maintenance of shock tube and RCM
- GPA 3.57/4.0 (Undergraduate) + 3.52/4.0 (Master)
- Major Courses: Programming Basis: Python and C (94/100), Combustion (91/100), Heat Transfer (91/100)

AWARDS AND HONORS

- Research Innovation Award (1/185), DLUT, 2017-2018
- Outstanding Merit Student (4/185), DLUT, 2017-2018
- Model Student of Academic Records (2nd Prize), DLUT, 2017-2018
- National College Mathematics Competition (3rd Prize), Chinese Mathematical Society, 03/2019
- China Innovation Methods Competition (2nd Prize), Ministry of Sci. and Tech. of China, 05/2019
- Undergraduate Innovation Training Program (Excellent grade), DLUT, 03/2020
- Full Master scholarship, KAUST, 2021-2023