Lawrence Lai

+1 (626)-202-2052 | laitcl@mit.edu | http://laitcl.mit.edu/

Highly motivated 6th year PhD Student in Chemical Engineering. Experienced with both computational and experimental methods. Highly organized leader, president of two student organizations seeking to leverage a broad spectrum of skills in industry.

Education

Massachusetts Institute of Technology — Cambridge, MA
PhD in Chemical Engineering — June 2019

- Thesis Title: Chemistry of Alkylaromatics in Crude Oil Upgrading
- Relevant coursework include managerial finance, machine learning, patent law, and entrepreneurship lab

University of Michigan, Ann Arbor — Ann Arbor, MI
B.S.E in Chemical Engineering — 2012

- Relevant coursework include process economics, and environmental and sustainable engineering

Recent Industry and Research Experience

Massachusetts Institute of Technology, — Cambridge, MA
Department of Chemical Engineering, PI: William H Green Lab — September 2013 – Present
PhD Candidate

- Characterized coke formation behavior through study of alkylaromatic reactions in supercritical water for petroleum upgrading using high pressure batch reactor and gas chromatography
- Achieved superior separation of hydrocarbons in alkylaromatic and petroleum related mixtures through development of 2-dimensional gas chromatography method
- Characterized chemical details of intricate alkylaromatic pyrolysis system through generation of chemical mechanisms using computational tools
- Calculated training data for machine learning algorithm in reaction mechanism generation algorithm by quantum methods; 154 species thermochemistry and 28 rate constants calculated
- Developed methods of rapid and efficient estimation of unknown species thermochemistry and reaction rate coefficients using group additivity methods, decision trees, and machine learning

Corning Inc. — Corning, NY and Wilmington, NC
Engineering Consultant — September 2014 – October 2014

- Identified corrective measures to improve damage resistance of existing product line of glass products through experimentation with controlled variables

General Mills — Minneapolis, MN
Engineering Consultant — November 2014 – December 2014

- Developed method to identify and eliminate potential safety hazard in 13 product lines

University of Michigan — Ann Arbor, MI
Undergraduate Research Assistant — May 2011 – December 2012

- Improved Isobutanol tolerance of E.coli to produce potent fuel source
- Introduced over 90 mutations to E.coli in multiplex method through use of mutagens
- Designed multiplex screening method to identify mutations in polymerase chain reaction and gel electrophoresis

Computational Skills

General computational skills: statistics, differential equations, estimation models (including machine learning), data visualization, and version control.
Software: Microsoft Excel, MATLAB, NumPy, Pandas, and GitHub.

Chemical engineering specific skills: quantum calculations, molecular geometry and frequency visualization, generating reaction and flow profiles, and process design.
Software: RMG, Gaussian 03/09/16, Gaussview, Q-Chem, Avogadro, ANSYS CHEMKIN-Pro, COMSOL Multiphysics, and ASPEN Plus.

Languages: Python, MATLAB, C++, HTML 5
Environment: MS-DOS/Windows, UNIX, X-Windows

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Leadership

President of MIT Sport Taekwondo September 2018 – Present

- Communicated student needs to instructors to better deliver towards student expectations
- Improved club operation leading to more efficient club management, better hygiene, and reduce injury risk

Teaching Assistant, 10.26 (Chemical Engineering Lab) December 2015 – May 2016

- Managed team of 3 students to construct new lab technique for nanoparticle sizing; eliminated infeasible sizing methods for industrial sponsor
- Intermediary for better communication between students and instructors

President of Hong Kong Student Society of MIT September 2014– August 2017

- Restructured student organization through constitutional changes to become more inclusive

Secretary of Omega Chi Epsilon – University of Michigan Chapter August 2012– December 2017

- Expanded student organization from 6 to 30 members
- Constructed new system and documented transition document to ease barrier to entry of secretary role

University of Michigan Engineering Council Director of Social Affairs January 2011– December 2011

- Hosted 6 events throughout calendar year to improve student well-being and connect unlikely contacts
- Formed new relationships between student government and school administration for future interaction

Languages

- Fluent in Cantonese Chinese
- Intermediate in Mandarin Chinese

Presentations

L. Lai, A. G. Carr, C. A. Class, S. Gudiyella, T. Monrose, M. Liu, and W. H. Green, "Supercritical Water Treatment of Alkyl Aromatics: Observations Beyond Model Predictions", American Institute of Chemical Engineers Annual Meeting, **2015**, Salt Lake City, UT.

L. Lai, S. Gudiyella, and W. H. Green, "Mechanisms of Consumption of Alkenes in Supercritical Water Treatment and Pyrolysis Of Hexylbenzene", International Symposium of Chemical Reaction Engineering, **2016**, Minneapolis, MN.

L. Lai and W. H. Green, "Thermochemistry of alkylaromatics reconsidered", American Institute of Chemical Engineers Annual Meeting, **2017**, Minneapolis, MN.

L. Lai and W. H. Green, "Modelling the formation of Two Ring Aromatics in Alkylaromatics Pyrolysis: Importance of Thermochemistry", International Symposium of Chemical Reaction Engineering, **2018**, Florence, Italy.

L. Lai and W. H. Green, "Elucidation of Hexylbenzene Pyrolysis Mechanism using 2-Dimensional Gas Chromatography with Quadrupole Mass Spectrometry (GCxGC-qMS) and Quantum Chemistry Model", American Institute of Chemical Engineers Spring Meeting, **2019**, New Orleans, LA.

Publications

L. Lai, W. H. Green, "Thermochemistry and Kinetics of Intermolecular Addition of Radicals to Toluene and Alkylaromatics", J. Phys. Chem. A. **2019**, Accepted.

L. Lai, S. Khanniche, W. H. Green, "Thermochemistry and Group Additivity Values for Fused Two Ring Aromatic Species and Radicals", J. Phys. Chem. A. **2019**, Accepted.

L. Lai, S. Gudiyella, M. Liu and W. H. Green, "Chemistry of Alkylaromatics Reconsidered", Energy Fuels, **2018**, 32 (4), 5489-5500.

L. Lai, H. Pang, and W. H. Green, "Formation of 2-Ring Aromatics in Hexylbenzene Pyrolysis", **2019**, in preparation.

S. Gudiyella, **L. Lai**, I. H. Borne, G. A, Tompsett, M. T. Timko, K. Choi, M. H. Alabsi, W. H. Green, "An Experimental and Modeling Study of Vacuum Residue Upgrading in Supercritical Water", AIChE J. **2018**, 64 (5), 1732-1743.

A. G. Carr, C. A. Class, **L. Lai**, Y. Kida, T. Monrose, W. H. Green, "Supercritical Water Treatment of Crude Oil and Hexylbenzene: An Experimental and Mechanistic Study on Alkylbenzene Decomposition", Energy Fuels, **2015**, 29 (8), 5290-5302.