



Sihe (Helena) Zhang



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EDUCATION

- Ph.D** Chemical Engineering, Auburn University, 2013
- B.S.E.** Chemical Engineering, Tianjin University, China, 2007
- B.S.** Financial Management, Tianjin University, China, 2007

TEACHING EXPERIENCE

- Assistant Professor, Department of Chemical Engineering
West Virginia University Institute of Technology, Aug 2020 – Present
 - CHE 330 Modelling and Analysis (Fall 2020)
 - CHE 435 Process Control (Fall 2020)
- Lecturer, lab supervisor, Department of Chemistry
Georgia Institute of Technology, 2018-2020
 - SO I-VIP-2601 Vertical Integrated Project (Fall 2018)
 - SR III-VIP-4603 Vertical Integrated Project (Spring 2019)
 - SO I-VIP-2601 Vertical Integrated Project (Fall 2019)
 - GT-VIP-6600 Vertical Integrated Project (Spring 2020)
- Lecturer, Department of Chemical Engineering
Auburn University, 2014
 - CHE 210 Principle of Chemical Engineering, Recitation Session (Fall 2014)
- Lecturer, Department of Biosystem Engineering
Auburn University, 2013
 - Biomass and Biofuels, Session: Processes involving heterogeneous catalysis in Gas-To-Liquid technology
- Graduate Teaching Assistant, Department of Chemical Engineering
Auburn University, 2007
 - Transport Phenomena, (Fall 2007)
- Graduate Teaching Assistant, Department of Chemical Engineering
Auburn University, 2008
 - Thermodynamics, (Spring 2018)

PROFESSIONAL SERVICE

Reviewer, Nanotechnology

Reviewer, RSC Advances

Reviewer, Material Chemistry and Physics

Advisor, AIChE Student Chapter, West Virginia University Institute of Technology

Postdoctoral fellow, Chemical Engineering & Chemistry, Georgia Institute of Technology, 2018-2020

- Assign and coordinate tasks for project teams, monitor task completion according to project plan, Develop screening techniques (New test capabilities, procedure, material analysis)

- Design, developing and optimizing the synthesis of energetic polymers utilizing continuous flow technology with advantages in reliability, scalability, atom economy, safety and sustainability
- Developing, building and optimizing a continuous flow reaction apparatus for the synthesis of chemicals such as propranolol and functional polymer
- Instructing, advising, and supervising undergraduate research and laboratory experiments in Vertically Integrated Projects (VIP) course

Postdoctoral research fellow, Biofuel Center, ChemE & Biosystem Engineering, Auburn University, 2013-2015

- Provided research guidance with lab technique, experimental design and data analysis for downstream processing of biomass-derived-synthesis-gas (syngas, a mixture of CO and H₂), assisted in the integration of downstream catalysis in the biomass-to-chemical technique
- Responsible for report and presentation of data on lab-scale and pilot-scale catalytic reactors (FBR and CSTR) in NSF-IGERT program
- Responsible for technical communication with RenTech Inc.
- Assisted in the setup and test of a new Renishaw In Via Raman Microscope in a catalysis group

Graduate Research Assistant, Catalysis and Supercritical Fluid Processing Laboratory, Auburn University

- Started a project on production of middle distillate range hydrocarbons from (natural gas/biomass/coal derived-) syngas, effectively modified the Fischer-Tropsch (FT) product distribution and distinguishably elevated the middle distillates selectivity
- Developed and characterized K and Cu promoted Fe based ZnO supported hydrocarbon synthesis catalysts, including physisorption & chemisorption for BET surface area and metal dispersion, surface imaging using JEOL SEM, surface element detection using EDS, determination of metal crystal size using XRD, activation of catalysts and measurement of catalyst activity
- Designed and set up an up to 3000 psi high pressure multi-bed continuous reactor system
- Operated a high temperature high pressure multi-bed continuous reactor system under both gas phase and supercritical phase conditions
- Investigated the oligomerization catalytic activity of amorphous silica alumina on Fischer-Tropsch reaction mixtures, successfully synthesized C₇-C₁₂ aromatics to enhance fuel density as well as decreased the olefin content which is a concern for Fe-based FT fuels
- Designed a SiO₂/Al₂O₃ supported Pd based hydrogenation/cracking/isomerization catalyst and investigated its catalytic activity, distinguishably increased the branching of carbon chain in the fuel range hydrocarbons which can promote the cold-flow properties of liquid fuels, significantly stimulated the hydrogenation of FT hydrocarbons which increase the stability of Fe-based FT fuels
- Applied supercritical solvent in Fischer-Tropsch synthesis to study the effect of supercritical solvent on the catalytic performance, including conversion, selectivity and productivity, effectively decreased the CH₄ and CO₂ selectivity, as well as changed the aldehydes and alcohol selectivities
- Designed and assembled a view cell system and investigated on near-critical/supercritical phase behavior of pentane, hexane, hydrocarbon mixtures and simulated FT reaction mixtures

RESEARCH EXPERTISE AND SKILLS

- 7+ years hand-on experience in synthesis gas reactions, CO hydrogenation, catalytic synthesis of hydrocarbons/oxygenated hydrocarbons, and hydrocarbon upgrading reactions (alkylation, oligomerization, hydrocracking/isomerization)
- 7+ years hand-on experience in catalyst synthesis, catalyst promoters and supporting materials, catalyst characterization, data analysis, equipment maintenance, operation, modification and troubleshooting of lab-scale continuous multiple-bed catalytic reactor system
- In-depth knowledge of heterogeneous catalysis, reaction engineering, reaction kinetics and experimental design

- Solid experience in catalyst design and screening, expertise in the synthesis of precious metal (Pd) nanoparticles, iron carbide catalysts, supported cobalt catalysts, metal oxides catalysts
- Solid experience in continuous flow technology, tunable solvent technology, supercritical fluid applications in reactions, phase behavior of hydrocarbon mixtures
- Solid experience in functional polymer synthesis and its optimization
- Hand-on experience on TiO₂ photocatalysts and VOC (Volatile Organic Compounds) photocatalysis reactive treatment
- Hand-on experience on application of macroporous adsorption resin on water pollution treatment (purification)
- Expertise in SEM, EDS, TEM, FT-IR, UV-Vis, BET, XRD, TPR, NMR, GPC, extensive experience in DSC, TGA, AA, Raman spectroscopy
- Solid computer skills in LabVIEW, FORTRAN, VB, Matlab, ChemCAD, SAS, R, AutoCAD, MestReNova

SELECTED PUBLICATIONS

- **Zhang S.**, Xu R., Zhu H., Pollet P., Liotta C., *et al.*, Introduction of Continuous-Flow chemistry in undergraduate education: Reaction of Diphenyldiazomethane with P-Nitro benzoic acid, Under review, Journal of Chemistry Education, 2020
- **Zhang S.**, Xu R., John P. Jr., Pollet P., Liotta C., *et al.*, Continuous flow chemistry of Propranolol synthesis, in preparation, 2020
- **Zhang S.**, Xu R., Durham E., Roberts C.B., "Middle Distillates Production via Fischer-Tropsch Synthesis with Integrated Upgrading under Supercritical Conditions", *AIChE Journal*, 2014, 60 (7)
- Xu R., **Zhang S.**, Stewart C., Durham E., Eden M.R., Roberts C.B., "Effect of Reaction Conditions on Supercritical Hexanes Mediated Higher Alcohol Synthesis over a Cu-Co-Zn Catalyst", *AIChE Journal*, 2014, 60 (5)
- Durham E., Stewart C., Roe D., Xu R., **Zhang S.**, Roberts C.B., "Supercritical Fischer-Tropsch Synthesis: Heavy Aldehyde Production and the Role of Process Conditions", *I&EC*, 2014, 53 (23)
- Xu R., **Zhang S.**, Roberts C.B., "Mixed Alcohol Synthesis over a K Promoted Cu/ZnO/Al₂O₃ Catalyst in Supercritical Hexanes", *I&EC*, 2013, 52 (41)
- Durham E., **Zhang S.**, Xu R., Eden M.R., Roberts C.B., "Supercritical Adiabatic Reactor for Fischer-Tropsch Synthesis," *I&EC*, 2013, 52(9)
- Durham E., **Zhang S.**, Xu R., Eden M.R., Roberts C.B., "Novel Adiabatic Reactor Design for Supercritical Fischer-Tropsch Synthesis", *Computer Aided Chemical Engineering*, 2012, 30
- **Zhang, S.**; Xu, R.; Durham, E.; Roberts, C.B.; "Advancement of Fischer-Tropsch Synthesis with Integrated Product Upgrading via Utilization of Supercritical Fluid Reaction Media," Proceeding paper for ISSF 2012: 10th *International Symposium on Supercritical Fluids*, San Francisco, May, 2012.
- Durham E., **Zhang S.**, Roberts C.B., "Diesel-length aldehydes and ketones via supercritical Fischer Tropsch Synthesis on an iron catalyst", *Applied Catalysis A : General*, 2010, 386 (1-2)
- Qin L., Zhang F., Zhang G., **Zhang S.**, "Adsorption behavior of NTS in aqueous solution on H1020 macroporous adsorption resin", *Chemical Reaction Engineering and Technology (Chinese)*, 2007
- Lv S., **Zhang S.**, Yang C., Xu C., Zhou M., "Study of Simulation on Synthesis of Dimethyl Carbonate by Slurry Catalytic Distillation", *Chemical Reaction Engineering and Technology (Chinese)*, 2006

SELECTED PRESENTATIONS

- **Zhang, S.**; Roe, D.; Xu, R.; Roberts, C.B.; "Advancement of Iron-Based Low Temperature Fischer-Tropsch Synthesis with Integrated Product Upgrading via Utilization of Supercritical Fluid Reaction Media", AIChE Annual Meeting, Pittsburgh, Oct 28- Nov 2, 2012
- Durham E.; **Zhang S.**; Xu R.; Eden M.R.; Roberts C.B.; "Novel Adiabatic Reactor Design for Supercritical Fischer-Tropsch Synthesis", 22nd European Symposium on Computer Aided Process Engineering (ESCAPE-22), London, UK, June 17-20, 2012

- **Zhang, S.;** Xu, R.; Durham, E.; Roberts, C.B.; “Advancement of Fischer-Tropsch Synthesis with Integrated Product Upgrading via Utilization of Supercritical Fluid Reaction Media,” ISSF 2012: 10th International Symposium on Supercritical Fluids, San Francisco, May 13-16, 2012.
- **Zhang, S.;** Xu, R.; Durham, E.; Roberts, C.B.; “Production of Middle Distillate Range Transportation Fuels from Synthesis Gas using Fischer-Tropsch Synthesis Technology on Iron-based Catalyst under Supercritical Phase Conditions”, American Chemical Society National Meeting, Denver, CO. August 2011.
- **Zhang, S.;** Durham, E.; Xu, R.; Roberts, C.B.; “Production of Middle Distillate Range Transportation Fuels from Synthesis Gas using Fischer-Tropsch Synthesis Technology under Supercritical Phase.” 2010 American Institute of Chemical Engineers Annual Meeting, paper 570s, November 7-12, Salt Lake City, UT, 2010.
- **Zhang, S.;** Xu, R.; Durham, E.; Roberts, C.B.; “Scalable Production of Middle Distillate Range Transportation Fuels using a Gas-to-Liquids Approach with Integrated Product Upgrading,” 23rd Annual Technical Meeting of the Consortium for Fossil Fuel Science, August 2009.
- Durham, E.; **Zhang, S.;** Roberts, C.B.; “Supercritical Reactivation of Fischer-Tropsch Catalysts,” 2008 American Institute of Chemical Engineers Annual Meeting: Catalysis and Reaction Engineering Division, Alternative Energy I Section, Philadelphia, PA, November 16-21, 2008.

SELECTED AWARDS AND HONORS

Teacher Appreciation Certificate, Georgia Institute of Technology, 2019

NSF Travel Grant for NSF Shale Gas Monetization Workshop, Texas, 2014

Best Presentation (nominated “Best Paper”), “Syngas production and Gas-To-Liquids Technology” Session, 2012 AIChE Annual Conference in Pittsburgh, PA

Graduate Student Travel Award, Graduate School, Auburn University, 2011, 2012

Graduate Student Award, Industrial & Engineering Chemistry Division (Co-sponsored by Fuel Division), American Chemical Society, 2011

Certificate of Accomplishment, Prepare Future Faculty Program, Biggio Center, Auburn University, 2011

Excellent Undergraduate Student Dissertation Defense, Tianjin University, 2007

Certificated in Public Relations and Protocol of Higher Education, the Public Relations Education Society, China Higher Education Institute, 2004

Public Scholarship, 2004, 2006

Sinopec China Scholarship, 2005

Who's Who Student, Tianjin University, 2003, 2004, 2006

Who's Who Student of City of Hohhot, 2003

Honorable member of Red Cross Volunteers, City of Hohhot, 2003