WENHUI LI

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EDUCATION

Ph.D. in Chemical Engineering 02/2015-05/2019 (expected)
Virginia Polytechnic Institute and State University (Virginia Tech) - Blacksburg, U.S.

M.Sc. in Chemical Engineering 09/2013-12/2014
Columbia University in the City of New York - New York, U.S.

B.S. in Material Chemistry 09/2009-07/2013
East China University of Science and Technology (ECUST) - Shanghai, China

RESEARCH EXPERIENCE

Ph.D. Research – Virginia Tech 02/2015-now
Graduate Research Associate in Prof. Ayman M. Karim's Laboratory

- Project topic: Ligand Effect on Mechanism and Kinetics of Colloidal Metal Nanoparticle Synthesis
  Correlated ligand – metal complex binding chemistry with nucleation and growth kinetics, to obtain a better understanding on the mechanism of colloidal metal nanoparticle synthesis. A kinetic model has been established based on the ligand controlled mechanism, which successfully describes and predicts not only particle size, but also the actual concentration of particles changing during the synthesis. Two subprojects have been conducted:

1. Solvent manipulation of the pre-reduction metal-ligand complex for controlled synthesis of Pd nanoparticles (collaboration with Michael G. Taylor and Prof. Giannis Mpourmpakis at University of Pittsburgh, Dr. Sergei Ivanov at Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Dr. Soenke Seifert and Dr. Byeongdu Lee at Argonne National Laboratory)
   - Realized controlled synthesis of Pd and Pt nanoparticles below 10 nm with narrow size distribution (< 20 %) using various ligands and solvents.
   - Extract in-situ kinetics of mean particle size, size distribution and concentration using synchrotron small angle X-ray scattering (SAXS).
   - Mapped phosphine ligand and Pd acetate binding chemistry in solvents of different coordinating abilities to synthesis kinetics.
2. Thermodynamic study on ligand-metal complex binding (collaboration with Dr. Sergei Ivanov at Center for Integrated Nanotechnologies, Los Alamos National Laboratory and Dr. Narasimhamurthy Shanaiah at Virginia Tech)
   - Developed an isothermal titration calorimetry (ITC) fitting model to extract the Gibbs free energy, enthalpy and entropy of Pd acetate trimer dissociation and phosphine – Pd acetate monomer binding.
   - Characterized Pd complex – ligand binding products using nuclear magnetic resonance (NMR).
   - Systematically quantified Gibbs free energy, enthalpy and entropy of different Pd complexes binding with phosphine ligands of different substituent groups.

Master Research – Columbia University in the City of New York 10/2013-12/2014
Graduate Research Associate in Prof. Jingguang Chen's Laboratory

- Project topic: Supported Catalysts and Metal-Modified Carbides for Carbon Dioxide Reduction
- Conducted supported Mo_2C and Nb-Mo carbide syntheses and studied support effects on catalytic properties on reverse water-gas shift reaction.

National University Student Innovation Program – Ministry of Education of China 10/2011-12/2011
Advised by Prof. Yi-tao Long, Shanghai Key Laboratory of Functional Materials Chemistry

- Program topic: Real-time Monitoring Hydrogen Peroxide Electrocatalytic Oxidation on Single Gold Nanorods
- Combined electrochemistry and dark-field scattering spectroscopy to monitor, in real-time, the electrocatalytic oxidation of hydrogen peroxide on a single gold nanoparticle.

PUBLICATIONS

Mozaffari, S., **Li, W. (co-first author)** et al., *Ligand-Mediated Nucleation and Growth of Palladium Metal Nanoparticles.* **J. Vis. Exp.***,* 2018, 136 (Protocol video link: www.jove.com/video/57667)

Mozaffari, S., **Li, W. (co-first author)** et al., *Colloidal nanoparticle size control: Experimental and kinetic modeling investigation of the ligand-metal binding role in controlling the nucleation and growth kinetics.* **Nanoscale**, 2017. 9: p.13772-13785

Li, W. et al., *Palladium Acetate Trimer: Understanding its Ligand-Induced Dissociation Thermochemistry Using Isothermal Titration Calorimetry, XAFS and ^{31}P NMR.* **Organometallics.** under review

Li, W. et al., *Solvent manipulation of the pre-reduction metal-ligand complex for controlled growth of metal Nanoparticles*. in submission

Porosoff, M.D., Kattel, S., **Li, W.** et al., *Identifying trends and descriptors for selective CO_2 conversion to CO over transition metal carbides.* **Chemical Communications**, 2015. 51(32): p. 6988-6991.

Jing, C., Rawson, F. J., Zhou, H., Shi, X., **Li, W.** et al., *New insights into electrocatalysis based on plasmon resonance for the real-time monitoring of catalytic events on single gold nanorods.* **Analytical Chemistry**, 2014. 86(11): p. 5513-5518.

CONFERENCE PRESENTATIONS

Mozaffari, S., **Li, W**., Thompson, C., Ivanov, S. & Karim, M. A.,*Role of ligands in controlling the nucleation and growth kinetics of colloidal metal nanoparticles.* 255th ACS National Meeting & Exposition. March, 2018, New Orleans, USA

Li, W., Taylor, G. M., Mozaffari, S., Ivanov, S., Mpourmpakis, G. & Karim, M. A., *Colloidal Pd Nanoparticle Synthesis: The Effect of Ligand-Metal-Solvent Thermodynamics on Kinetics and Final Size*. AIChE Annual Meeting, November,2017, Minneapolis, USA (Oral presentation)

Li, W., Ivanov, S., Mozaffari, S., Taylor, M. G., Mpourmpakis, G. & Karim, M. A., *Solvent Effect on Metal-Ligand Interactions in Pd Nanoparticle Synthesis*. 245th American Chemical Society National Meeting, April, 2017, San Francisco, USA (Oral presentation)

Mozaffari, S., **Li, W**., Hu, P., Thompson, C., Ivanov, S. & Karim, M. A., *Predictive Synthesis of Catalytic Metal Nanoparticles Using in-Situ SAXS and Kinetic Modeling.* 25th North American Catalysis Society Meeting, June, 2017, Denvor, CO, USA

Li, W., Mozaffari, S. & Karim, M. A., *Effect of Ligands on Synthesis Mechanisms and Kinetics of Pd Colloidal Nanoparticles*. Southeastern Catalysis Society Symposium, September, 2016, Asheville, USA (Oral presentation)

Li, W. & Karim, M. A., *Effects of Ligand on Synthesis Mechanism and Kinetics of Colloidal Palladium Nanoparticles.* ChEGSA Symposium, April, 2016, Blacksburg, USA (Oral presentation)

Mozaffari, S., **Li, W**., Thompson C., Hasan A. N., Ivanov S., Siefert S., Vlachos G. D., Datye K. A.,Karim, M. A. Kinetic Modeling of Nucleation and Growth of Metal Nanoparticles in the Presence of Capping Ligands. Southeastern Catalysis Society Symposium, September, 2015, Asheville, USA

Li, W. & Karim, M. A., *Effect of Ligands on Synthesis Mechanisms of Pd Colloidal Nanoparticles*. Southeastern Catalysis Society Symposium, September, 2015, Asheville, USA (Poster presentation)

REFERENCES

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Prof. Giannis Mpourmpakis
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