Forging Robust Nanoscale Catalytic Interfaces for a Sustainable Future

Dr. Junrui Li

Postdoctoral research associate in the Voiland School of Chemical Engineering and Bioengineering, Washington State University

Chemistry Seminar on *Nanoscale catalyst interface*

Thursday March 16 at 4 pm in 303 Schrenk

Please contact Dr. Manashi Nath at nathm@mst.edu for further information.

MISSOURI S&T

Abstract: There has been increasing interest in achieving a sustainable future with fuels, chemicals and materials obtained from renewable sources. Sustainable materials and energy production requires efficient catalytic processes. Rational design and development of robust catalysts for such processes remains a key challenge. Despite extensive efforts in this research area, new innovations in effective catalytic design at nanoscale levels are limited. This talk covers examples of how robust catalytic interface can be precisely tailored at nanoscale dimensions to achieve an improved performance in green energy power source-fuel cells and in catalytic valorization of renewable biomass-derived molecules. The first section illustrates: (1) intermetallic nanostructures with ordered atomic arrangements can stabilize base metals under the aggressive condition of fuel cells; (2) hard-magnet intermetallic nanostructure interfaced with atomically thin Pt overlayers that exhibit extraordinary fuel cell performance; (3) identification of a structural descriptor to guide high-throughput screening and discovery of high-performance catalysts for fuel cells. The second and third sections detailing oxidative valorization of biomass-derived molecules outlines: (1) the discovery and investigation of a Pt-based ternary nanoscale interface that steers the favorable reaction pathway for efficient electrocatalytic utilization of biomass-derived liquid fuels; (2) interfacing Pt with Au at nanoscale dimensions to suppress the oxidation/dissolution of Pt during thermocatalytic oxidation of glucose to achieve high yields to value-added products and long-term stability.

About the speaker: Junrui Li received his Ph.D. in Chemistry from Brown University in 2019, where he studied the synthesis, characterization, and applications of nanomaterials in fuel cells and other catalytic reactions under the supervision of Prof. Shouheng Sun. He then worked as a postdoctoral scholar at the Joint Center for Artificial Photosynthesis, Lawrence Berkeley National Laboratory, on (photo)electrochemical conversion of CO_2 into sustainable fuels and chemicals with Prof. Joel W. Ager III. Currently, he is a postdoctoral research associate in the Voiland School of Chemical Engineering and Bioengineering, Washington State University, working with Prof. Yong Wang on developing atomically precise catalysts for biomass conversion. Junrui is a recipient of the Sigma Xi award for Excellence in Graduate Research (2019), the IPMI (International Precious Metal Institute)-Metalor Technologies Graduate Student Award (2018) and many National Scholarships for Students.