Liliana Bello, Ph.D.

Associate | Data Sciences
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Professional Profile

Dr. Liliana Bello is a chemical engineer with a background in computational modeling. Dr. Bello leverages fundamental understanding of polymer physics and computational simulations to solve problems across industries including but not limited to energy storage, medical device manufacturing, and consumer products packaging. Her expertise includes building mesoscopic coarse-grained models using Brownian dynamics, Monte Carlo techniques and programming in C/Python. She also has experience using modeling software such as LAMMPS, COMSOL, Aspen, UniSim, and ChemCAD.

By using a coarse-grained approach and theoretical polymer physics, Dr. Bello's research at the University of Illinois Urbana Champaign focused on elucidating the fundamental underpinnings of charge transport mechanisms and how those interplay with polymer conformational effects and diffusive translational motions. Her research provided molecular level detail information to design redox-active polymer solutions by exploring the dilute and semi-dilute regimes, and effects of valency (counterion condensation) and salt concentration.

Previously, Dr. Bello interned with Johnson & Johnson Ethicon Endo-Surgery as a Development Engineer where she used COMSOL and ChemCAD to model a chemical extraction process. She additionally developed more energy and material efficient method for a chemical extraction process in the medical device sector for which she used Fourier Transform Infrared (FTIR) spectroscopy and Scanning Electron Microscope (SEM) imaging to show proof-of-concept.

Dr. Bello has also interned with Intel as a Process Engineer where she automated process interchangeability between types of process tools and two mechanical partitioning tests to improve quality, productivity, and accessibility of historical data for technicians and process engineers. Dr. Bello earned her Ph.D. in Chemical Engineering at the University of Illinois-Urbana-Champaign in 2023, an M.S. in Chemical Engineering, University of Illinois, Urbana-Champaign in 2021 and a B.S. in Chemical Engineering with a minor in Packaging Science, at the University of Florida in 2018. She is also fluent in Spanish.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, University of Illinois at Urbana-Champaign, 2023

M.S., Chemical Engineering, University of Illinois at Urbana-Champaign, 2021

B.S., Chemical Engineering, University of Florida, 2018

Materials Science & Engineering Teaching Award - April 2023

J&J GEM Fellowship August 2022-July 2023

SCS Teaching Award May 2022

llinois Sloan Scholarship July 2018 – July 2023

School of Chemical Sciences (SCS) Teaching Award - May 2020

Ronald E. McNair Scholar May 2017-May 2018

AIChE Minority Scholarship Recipient Fall 2017

Prior Experience

R&D Development Intern – Ethicon Endo-Surgery, May 2022-Aug 2023

Process Engineering Intern – Intel, Fall 2015 and Summer 2016

Professional Affiliations

2023-2025 Early Career Member – Executive Committee, American Physical Society – Division of Polymer Physics

American Physical Society – Division of Polymer Physics (2018-Present)

American institute of Chemical Engineers (2013-Present)

Society of Hispanic Professional Engineers (2013-Present)

GEM Fellow (2018-Present)

Illinois Sloan Scholar (2018-2023)

Publications

L. Bello and C. E. Sing, “Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions,” Macromolecules, p. acs.macromol.0c01672, Sep. 2020.

J. Yang, L. Bello, K. Buettner, Y. Guo, C. Wassgren, and J. S. Curtis, “Breakage of wet flexible fiber agglomerates impacting a plane,” AIChE J., vol. 65, no. 8, 2019

Presentations

L Bello, CE Sing. Diffusive Charge Transport in High-Valency Redox-Active Polymer Solutions. Talk, American Physical Society, Las Vegas, NV, 2023

L Bello, CE Sing. Diffusive Charge Transport in High-Valency Redox-Active Polymer Solutions. Talk, American Institute of Chemical Engineers, Phoenix, AZ, 2022

L Bello, CE Sing. Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions. Poster Presentation. GEM Annual Meeting, Phoenix, AZ 2022

L Bello, CE Sing. Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions. Poster Presentation, Polymer Physics Gordon Research Symposium, Mt. Holyoke, MA, 2022

L Bello, CE Sing. Oxidation of High Valency Redox Active Polymer Solutions in Explicit Salt. Talk, American Physical Society, Chicago, IL, 2022

L Bello, CE Sing. Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions. Poster Presentation. GEM Annual Meeting, Houston, TX 2021

L Bello, CE Sing. Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions. Online Talk, Midwestern Thermodynamics and Statistical Mechanics Conference, 2021

L Bello, CE Sing. Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions. Online Talk, American Physical Society, 2021

L Bello, CE Sing. Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions. Online Talk, Virtual Polymer Physics Symposium, 202

L Bello, CE Sing. Mechanisms of Diffusive Charge Transport in Redox-Active Polymer Solutions. Poster Presentation. Midwestern Thermodynamics and Statistical Mechanics Conference, Champaign, IL 2019

L Bello, K Buettner, Y Guo, V Lane, H Kalman, JS Curtis. Computational and Experimental Shear Cell Study with Rigid Cylindrical Particles 8th World Congress on Particle Technology. Poster, Orlando, FL 2018

Project Experience

Project 1: Modeled linear Redox Active Polymer (RAP) charge transport in dilute and semi-dilute solutions using a combined Brownian dynamics and Monte Carlo simulation. Utilized RAP model to show different charge transport mechanisms, including the intra-polymer transport of charge both along the chain via self-exchange transport and polymer segmental motions, as well as hopping due to inter-polymer collisions and translational diffusion of the chains. Provided theoretical arguments to describe the diffusive motion of charge via these mechanisms and achieved excellent agreement between simulation and theory. Extended this model to consider explicit salt-counter ions and higher valency RAPs to further understand charge hopping dynamics in flow batteries.

Project 2: Modeled a chemical extraction process for the development of a medical device cleaning procedure using ChemCAD and COMSOL where I was able to quantify the number of required stages to reach a safe level of residual chemicals in a medical device, flow rates required, temperature profiles, velocity profiles, and residence time for the current stage design. Conducted experiments and subsequent FTIR testing for a solvent alternative that will chemically react the residual chemicals to convert them into an aqueous species for easier, safer, and potentially greener extraction from medical device to replace current extraction protocol using organic solvents.

Project 3: Recreated a Schulze ring shear tester in a Discrete Element Method simulation with rigid glued-sphere cylindrical particles to examine the effects of coefficient of restitution, coefficient of friction, and other particle properties on the measured steady-state stress and compared it to experimental work. Studied the impact breakage of a wet flexible fiber agglomerate using Discrete Element Method (DEM) simulations to see the effect of surface tension, liquid to solid volume ratio, contact angle, and viscosity on the extent of breakage to model the comminution of biomass in a hammer mill.

Project 4: Analyzed government consumer databases such as NEISS, Clearinghouse, MAUDE, and Safer Products for facial injuries using Python to provide insights for a VR/AR device literature review. Created queries to search for keywords of interest for the client to capture demographic insights of facial contact injuries. Produced subsequent plots to visualize break down of injuries, causes, and demographic information.

Project 5: Completed a literature review of a polymer undergoing EPA approval to highlight the possible outcome of its atmospheric degradation. Using the literature, created a potential reaction scheme for this chemical component of concern and how it could yield the chemical species of concern. Calculated the theoretical maximum generation of the chemical of concern for given manufacturing and exportation estimates.