

Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Song is a chemical engineer and polymer scientist by training with an expertise in developing photo-curable materials, stimuli-responsive polymers, and thermosetting composites for biomedical device applications. Her research specialties include photochemical processes, polymer syntheses, resin formulations, and structure-property relationships. Aided with her research background in polymer characterization, Dr. Song actively engages in root cause failure analysis of industrial polymers. In addition, Dr. Song is a registered patent agent, assisting clients with intellectual property matters.

Dr. Song has utilized a wide spectrum of characterization techniques for analyzing physical, mechanical, chemical, and optical properties of polymers. These include but are not limited to Fourier Transform Infrared Spectroscopy, Dynamic Mechanical Thermal Analysis, Thermogravimetric Analysis, Differential Scanning Calorimetry, Rheometry, Tensometry, UV/Vis Spectroscopy, and Nuclear Magnetic Resonance Spectroscopy. Dr. Song has extensive research experience in photopolymerizations, step-growth polymerizations, and free radical chain-growth polymerizations for the development of dental restorative composites.

Prior to working at Exponent, Dr. Song worked as a postdoctoral researcher at ADA Science & Research Institute (ADASRI) and as a contractor at National Institute of Standards and Technology (NIST). Her research focused on developing stimuli-responsive polyelectrolytes and antimicrobial polymers for Class V dental restorative materials. Before working at ADASRI and NIST, Dr. Song received a Ph.D. in Chemical Engineering from University of Colorado at Boulder where she studied developing UV-curable glassy thermosets based on “click” chemistries with high toughness and ductility for 3D printing applications.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, University of Colorado, Boulder, 2018

B.S., Chemical Engineering, Soongsil University, South Korea, 2012

Soongsil University Fellowship, 2016

Licenses and Certifications

Licensed Patent Agent

Academic Appointments

Teaching Assistant, Materials & Energy Balances, University of Colorado at Boulder, 2016

Teaching Assistant, Tissue Engineering & Medical Devices, University of Colorado at Boulder, 2014

Prior Experience

Postdoctoral Researcher, ADA Science & Research Institute, 2019 - 2022

Graduate Research Assistant, University of Colorado at Boulder, 2013 - 2018

Languages

Korean

Publications

Wang, X; Gao, G; Song, HB; Zhang, X; Stansbury, JW; Bowman, CN. Evaluation of a photo-initiated copper(I)-catalyzed azide-alkyne cycloaddition polymer network with improved water stability and high mechanical performance as an ester-free dental restorative. Dental Materials 2021; 37 (10):1592-1600.

Song, HB; Sowan, N; Baranek, A; Sinha, J; Cook, WD; Bowman, CN. Effects of network structures on the tensile toughness of copper-catalyzed azide-alkyne cycloaddition (CuAAC)-based photopolymers. Macromolecules 2021; 54 (2):747-756.

Sowan, N; Song, HB; Cox, LM; Patton, JR; Fairbanks, BD; Ding, Y; Bowman, CN. Light-activated stress relaxation, toughness improvement, and photoinduced reversal of physical aging in glassy polymer networks. Advanced Materials 2021; 33 (5):2007221.

Sinha, J; Fairbanks, BD; Song, HB; Bowman, CN. Phosphate-based cross-linked polymers from iodo-ene photopolymerization: tuning surface wettability through thiol-ene chemistry. ACS Macro Letters 2019; 8 (2):213-217.

Song, HB; Baranek, A; Worrell, BT; Cook, WD; Bowman, CN. Photopolymerized triazole-based glassy polymer networks with superior tensile toughness. Advanced Functional Materials 2018; 28 (22):1801095. (Featured as a Front Cover and Advanced Science News)

Sowan, N; Cox, LM; Shah, PK; Song, HB; Stansbury, JW; Bowman, CN. Dynamic covalent chemistry at interfaces: development of tougher, healable composites through stress relaxation at the resin-silica nanoparticles interface. Advanced Materials Interfaces 2018; 5 (18):1800511.

Zajdowicz, S; Song, HB; Baranek, A; Bowman, CN. Evaluation of biofilm formation on novel copper-catalyzed azide-alkyne cycloaddition (CuAAC)-based resins for dental restoratives. Dental Materials 2018; 34 (4):657-666.

Alzahrani, A; Saed, M; Yakacki, CM, Song, HB; Sowan, N; Walston, JJ; Shah, PK; McBride, MK; Stansbury, JW; Bowman, CN. Fully recoverable rigid shape memory foam based on copper-catalyzed azide-alkyne cycloaddition (CuAAC) using a salt leaching technique. Polymer Chemistry 2018; 9 (1):121-130.

Song, HB; Wang, X; Patton, JR; Stansbury, JW; Bowman, CN. Kinetics and mechanics of photo-polymerized triazole-containing thermosetting composites via the copper(I)-catalyzed azide-alkyne cycloaddition. Dental Materials 2017; 33 (6):621-629.

Song, HB; Sowan, N; Shah, PK; Baranek, A; Flores, A; Stansbury, JW; Bowman, CN. Reduced shrinkage stress via photo-initiated copper(I)-catalyzed cycloaddition polymerizations of azide-alkyne resins. Dental Materials 2016; 32 (11):1332-1342.

Song, HB; Baranek, A; Bowman, CN. Kinetics of bulk photo-initiated copper(I)-catalyzed azide-alkyne cycloaddition (CuAAC) polymerizations. Polymer Chemistry 2016; 7 (3):603-612.

Baranek, A; Song, HB; McBride, M; Finnegan, P; Bowman, CN. Thermomechanical formation-structure-property relationships in photopolymerized copper-catalyzed azide-alkyne (CuAAC) networks. Macromolecules 2016; 49 (4):1191-1200.

Kim, MH; Song, HB. Analysis of the global warming potential for wood waste recycling systems. Journal of Cleaner Production 2015; 69:199-207.

Kim, MH; Song, HB; Song, YE; Jeong, IT; Kim, JW. Evaluation of food waste disposal options in terms of global warming and energy recovery: Korea. International Journal of Energy and Environmental Engineering 2013; 4 (1):1-12.

Kim, MH; Song, YE; Song, HB; Kim, JW; Hwang, SJ. Evaluation of food waste disposal options by LCC analysis from the perspective of global warming: Jungnag case, South Korea. Waste Management 2011; 31:2112-2120.

Presentations

Song HB, Baranek A, Worrell BT, Cook WD, Bowman CN. Mechanically ductile and stiff, triazole-based glassy photopolymer network. Oral presentation, American Institute of Chemical Engineers Annual Meeting, Minneapolis, MN, 2017.

Song HB, Wang X, Patton JR, Stansbury JW, Bowman CN. Kinetics and mechanics of photo-initiated Copper(I)-catalyzed Azide-alkyne Cycloaddition (CuAAC) composites. Oral presentation, International Association for Dental Research Annual Meeting, San Francisco, CA, 2017.

Song HB, Sowan N, Baranek A, Shah P, Flores A, Stansbury JW, Bowman CN. Reduced shrinkage stress via CuAAC photopolymerizations. Oral presentation, American Association for Dental Research Meeting, Los Angeles, CA, 2016.

Song HB, Baranek A, Mcbride MK, Gong T, Flores A, Kloxin CJ, Stansbury JW, Bowman CN. Optimizing photo-CuAAC polymerization kinetic for dental restorative materials. Oral presentation, American Chemistry Society National Meeting, Denver, CO, 2015.

Song HB, Baranek A, Mcbride MK, Gong T, Flores A, Kloxin CJ, Stansbury JW, Bowman CN. Kinetics of photo-"click" CuAAC polymers for dental resins. Oral presentation, International Association for Dental Research Annual Meeting, Boston, MA, 2015.

Song HB, Frukhtbeyn S, Torres Jr. L, Giuseppetti AA, Bienek DR. Shrinkage stress and thermo-mechanical properties of quaternary ammonium-based composites. Poster presentation, International Association for Dental Research Annual Meeting, Boston, MA, 2021.

Song HB, Wang X, Orski S, Beers K, Prabhu V, Sun J. pH-responsive Azo-QPS containing polymers. Poster presentation, Semi-Annual NIST-ADA CRADA Symposium, Gaithersburg, MD, 2019.

Song HB, Baranek A, Bowman CN. Toughness of mechanically assisted triazole-based glassy photopolymer network. Poster presentation, Photopolymerization Fundamentals Meeting, Boulder, CO, 2017.

Song HB, Wang X, Patton JR, Stansbury JW, Bowman CN. Kinetics and mechanics of photo-CuAAC

composites. Poster presentation, Industry/University Cooperative Research Centers Meeting, Estes Park, CO, 2016.

Song HB, Sowan N, Baranek A, Shah P, Flores A, Stansbury JW, Bowman CN. Reduced shrinkage stress of photo-CuAAC polymerization. Poster presentation, Industry/University Cooperative Research Centers Meeting, Boulder, CO, 2016.

Song HB, Baranek A, Wang C, Flores A, Bowman CN. Systematic kinetic study on photo-initiated CuAAC polymerization. Poster presentation, Photopolymerization Fundamentals Meeting, Boulder, CO, 2015.

Song HB, Baranek A, Wang C, McBride MK, Flores A, Bowman CN. Systematic study on kinetics of photo-CuAAC polymerization. Poster presentation, Industry/University Cooperative Research Centers Meeting, Seattle, WA, 2015.