

Exponent®
Engineering & Scientific Consulting

Liat Kugelmass, Ph.D.

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Professional Profile

Liat Kugelmass, Ph.D., is a polymer chemist whose work focuses on understanding the relationship of polymer chemistry and composition to material performance attributes. She specializes in plastics sustainability and green chemistry synthesis. She has expertise in mechanical and chemical polymer/plastic recycling, as well as understanding the impacts of plastic additives on these processes. Dr. Kugelmass has expertise related to plastic biodegradation and the physical and chemical properties that impact plastic degradation and microplastic formation. Her work includes bio-derived plastics and coatings, with applications in food and beverage and cosmetics packaging, as well as fire-retardant materials, specialty textile coatings, and transient materials (e.g., electronics and sensors).

Dr. Kugelmass leverages her experience in organic chemistry and polymer chemistry to study the impacts of small and large molecule additives in polymer systems at various stages of the plastics lifecycle: polymer synthesis, polymer processing, product performance, recycling, and biodegradation. Her technical expertise includes organic molecule and polymer synthesis, nanoparticle synthesis, photochemistry and advanced characterization techniques such as Ultra-Violet and Visible light spectroscopy (UV-Vis), Fluorimetry, Fourier Transform Infrared spectroscopy (FTIR), Nuclear Magnetic Resonance (NMR), Size Exclusion Chromatography (SEC)/ Gel Permeation Chromatography (GPC), Differential Scanning Calorimetry (DSC), Thermal Gravimetric Analysis (TGA), Dynamic Light Scattering (DLS), Polarized Light Optical Microscopy (PLOM), X-Ray Photoelectron Spectroscopy (XPS), and mechanical testing (e.g., tensile testing). Dr. Kugelmass is also experienced in polymer processing techniques such as solvent casting, hot pressing, and extrusion. She routinely utilizes ASTM and other industry standard methods in her project work and also develops novel methods for unique testing needs.

Prior to joining Exponent, Dr. Kugelmass studied the impact of chemical composition on the processability and performance of petroleum and bio-derived polymers (e.g., low-density polyethylene – LDPE, polycaprolactone – PCL, polyhydroxyalkanoates – PHAs), for use in food packaging and fire-resistant materials. Using her background in polymer science, she has interfaced with members of the food packaging industry to support the development of compostable products. Her work also included the design of reconfigurable DNA-cationic lipid-based water- and oil-repellent coatings for paper packaging applications. Dr. Kugelmass also investigated how material processing history can influence the marine biodegradation of semi-crystalline polymers.

In her doctoral research, Dr. Kugelmass investigated chemical recycling of commercially relevant polymers (e.g., polystyrene – PS, polylactic acid – PLA, polymethylmethacrylate – PMMA, photoresists, etc.) using the photochemistry of embedded nanoparticles. This work included the synthesis of metallic and carbon-based nanoparticles (e.g., magnetite, carbon quantum dots, carbon black), formulation of polymers using these nanoparticles to form composites, and design of photochemical reactions that facilitate the break-down (depolymerization) of commercial plastics as a mode of recycling that allows for the recovery of the plastic's constituents (monomers). This research addressed the complexities of real-

world plastics, such as additives, contaminants, aging, and wear, and the challenges they pose to efficient recycling.

Academic Credentials & Professional Honors

Ph.D., Chemistry, Cornell University, 2023

M.S., Chemistry, Cornell University, 2021

B.A., Chemistry, Vassar College, 2018

Postdoctoral Associate Award, American Institute of Chemists, 2026

Polymeric Materials Science and Engineering (PMSE) Emerging Professional Award, American Chemical Society, 2026

Nina McClelland Memorial Award, American Chemical Society Green Chemistry Institute, 2026

Graduate Safety Representative Catalyst Safety Prize, Cornell University, 2023

Bauer Scholarship Award, Cornell University, 2022

Cornell Graduate Fellowship, Cornell University, 2019-2020

American Chemical Society College Recognition Award, Vassar College, 2018

Prior Experience

Postdoctoral Research Associate, Northeastern University, Boston, 2025-2026

Senior Fellow, Institute on Science for Global Policy, 2024-2025

Professional Affiliations

American Chemical Society (ACS) — Member

Patents

James BD, Kugelmass LH. Oligonucleotide-based bio-additives for plastics. U.S. Patent Application No. 19/813,912. September 21, 2026.

James BD, Kugelmass LH. DNA-cationic lipid coatings. U.S. Provisional Patent Application No. 63/972,153. January 30, 2026.

Stache EE, Kugelmass LH. Carbon quantum dots from ascorbic acid induce solid-phase photothermal depolymerization under visible light. U.S. Provisional Patent Application No. 63/383,419. November 11, 2022.

Publications

Kugelmass LH, James BD. Circular, reconfigurable DNA-surfactant materials for coatings with tunable oil and water barrier properties. ACS Sustainable Chemistry & Engineering 2026; 14(44):20511–20522.

Kugelmass LH, Megill C, Vélez Díaz J, Gallagher K, Goldberg A, Pfluger CA, Eckelman MJ, James BD.

Opportunities for higher education to develop a workforce to support a circular plastics economy. Chem Circularity 2026; 1(6):100145.

Oh S, Jiang H, Kugelmass LH, Stache EE. Recycling of post-consumer waste polystyrene using commercial plastic additives. ACS Central Science 2025; 11(1):57–65.

Kugelmass LH, Tagnon C, Stache EE. Photothermal mediated chemical recycling to monomer via carbon quantum dots. J. Am. Chem. Soc. 2023; 145(29):16090–16097.

Rowe AR, Salimijazi F, Trutschel L, Sackett J, Adesina O, Anzai I, Kugelmass LH, Baym MH, Barstow B. Identification of a pathway for electron uptake in Shewanella oneidensis. Nature Communications Biology 2021; 4:957.

Bendavid LI, Kugelmass LH. Doping and interfacial modification of the P3HT/ZnO photovoltaic interface: insights from density functional theory. Surface Science 2020; 695:121575.

Presentations

Kugelmass LH. Multi-functional, bio-derived polymer additives with full material life cycle design. Invited Talk, American Chemical Society Fall National Meeting, Chicago, IL, 2026.

Kugelmass LH. Bio-derived, amphiphobic coatings with circular design. Oral Presentation, American Chemical Society Fall National Meeting, Chicago, IL, 2026.

Kugelmass LH. Design of bio-derived polymer additives across the full material life cycle. Invited Talk, American Chemical Society Green Chemistry Institute Green Chemistry & Engineering Conference, San Antonio, TX, 2026.

Kugelmass LH. Self-assembled, bio-derived, omniphobic coatings with circular design. Oral Presentation, American Chemical Society Green Chemistry Institute Green Chemistry & Engineering Conference, San Antonio, TX, 2026.

Kugelmass LH. Bio-derived amphiphobic coatings for a circular economy. Poster Presentation, PoWER: Polymer Women Empowerment & Research, Toronto, Ontario, Canada, 2026.

Kugelmass LH. Engineering nucleic acids and benign, multi-functional polymer additives. Oral Presentation, American Chemical Society Spring National Meeting, Atlanta, GA, 2026.

Kugelmass LH. DNA-surfactant self-assembly based coatings: Exploring structure-property relationships. Oral Presentation, American Chemical Society Spring National Meeting, Atlanta, GA, 2026.

Kugelmass LH. Engineering biomacromolecules as benign polymer additives. Poster Presentation, American Institute of Chemical Engineers Annual Meeting, Boston, MA, 2025.

Kugelmass LH. Structure-property relationships for DNA-cationic lipid-based materials. Poster Presentation, American Chemical Society Green Chemistry Institute Pharma Roundtable 20th Anniversary event, Cambridge, MA, 2025.

Kugelmass LH. Photothermal catalysis for chemical recycling of polymers. Invited Talk, Bauer Scholarship Award Lecture, Vassar College, Poughkeepsie, NY, 2023.

Kugelmass LH. New methods for polymer chemical recycling to monomer. Oral Presentation, American Chemical Society Northeast Regional Meeting, Rochester, NY, 2022.

Kugelmass LH. Photothermal depolymerization to monomer by carbon quantum dots. Poster Presentation, Gordon Research Conference, Stereochemistry, Newport, RI, 2022.

Additional Education & Training

Green and Sustainable Chemistry Summer School, American Chemical Society Green Chemistry Institute, 2026

Polymeric Materials course, Schrödinger, 2025

Peer Reviews

Reviewer for Journal of the American Chemical Society

Reviewer for Angewandte Chemie