Northeastern University
College of Engineering

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Distinguished Seminar Speaker

Design strategies to minimize the environmental impacts of plastic products

Bryan D. James

Postdoctoral Investigator | Woods Hole Oceanographic Institution (WHOI) | Woods Hole, MA

Abstract: Combatting the existential threats of climate change and pollution requires circularizing and decarbonizing material lifecycles, reducing persistence, and eliminating the toxicity of products and processes. Plastics, the combination of polymer and chemical additives, contribute significantly to both threats. Despite these harms, plastics are crucial materials for modern society. In their recent report, the U.S. National Academies of Sciences, Engineering, and Medicine identified material and product design as one of six key interventions to tackle plastic pollution. With this charge, I will demonstrate how combining concepts learned from the last decade of plastic pollution research with established material selection practices resulted in a quantitative, multi-dimensional framework for use during product design to minimize the environmental impacts of plastic. By taking this approach, a sustainability metric was developed for the design of plastic products with low environmental persistence and uncompromised performance. Applying this methodology to commonly littered plastic products (drinking straws and coffee cup lids) demonstrated that accounting for persistence in product design could reduce the societal impacts of plastic pollution by hundreds of millions of dollars for a single product. My findings identify the materials and their properties that deserve development, adoption, and investment to create functional and less environmentally impactful plastic products.

Biography: Dr. Bryan D. James is a Postdoctoral Investigator at the Woods Hole Oceanographic Institution (WHOI). As part of an interdisciplinary team of scientists and engineers within WHOI's Microplastics Initiative, his postdoctoral research focuses on understanding the fate, persistence, and toxicity of plastic in the ocean to inform the rational design of next-generation materials that are safe for people and the planet. Through this work, Bryan has collaborated globally with academic colleagues, NGOs, and industrial partners and regularly engages with K-12 educators, mentors community college students, and advises policymakers. Bryan received his B.A.Sc. in materials engineering from the University of Toronto and his Ph.D. in materials science and engineering from the University of Florida (UF). At UF, as an NIH F31 Predoctoral Fellow under the mentorship of Prof. Josephine Allen, Bryan pioneered the use of nucleic acid-collagen complexes for hard and soft tissue engineering and championed investigating sex as a biological variable in biomaterials research, identifying mechanobiological sex differences in vascular cells. Bryan has been recognized with multiple early career honors and awards, including being named a Rising Star in Engineering in Health, a CAS Future Leader, a DYSS speaker, and an ACS PMSE Future Faculty Scholar.

Department of Chemical Engineering
201Cullinane Hall
Northeastern University
360 Huntington Avenue
Boston, MA 02115