MIT ESI Plastics and the Environment Program (ESI-PEP)

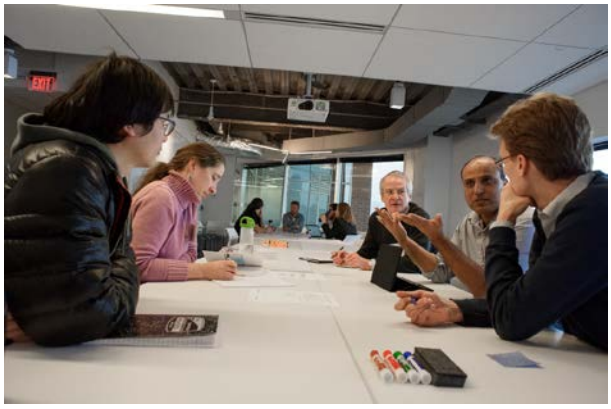
Program summary for Supporting Members:

As part of its Sustainable Production and Consumption domain area, the MIT Environmental Solutions Initiative (ESI) is launching a campus-wide program to address the challenges of the impact of plastics on our environment. This program includes:

- Research, education and convening activities;
- Participation by a broad cross-section of MIT faculty;
- Collaborative projects with a wide range of partner institutions;
- Opportunities for undergraduate and graduate students;
- A broad cross-section of Supporting Members: for-profit corporations, trade associations, foundations, government agencies, consultants and individuals;
- Networking opportunities between the ESI-PEP Supporting Members and the MIT community.

Genesis of ESI-PEP:

ESI organized a 1-day workshop in January 2018 that brought together 80+ faculty, students, researchers from industry and government agencies, policy-makers and other domain experts to discuss the current state of knowledge and activity concerning plastics in the environment, with a focus on microplastics. This workshop helped us define the initial agenda of ESI-PEP.



Breakout session at ESI-PEP launch workshop

Plenary session at ESI-PEP launch workshop

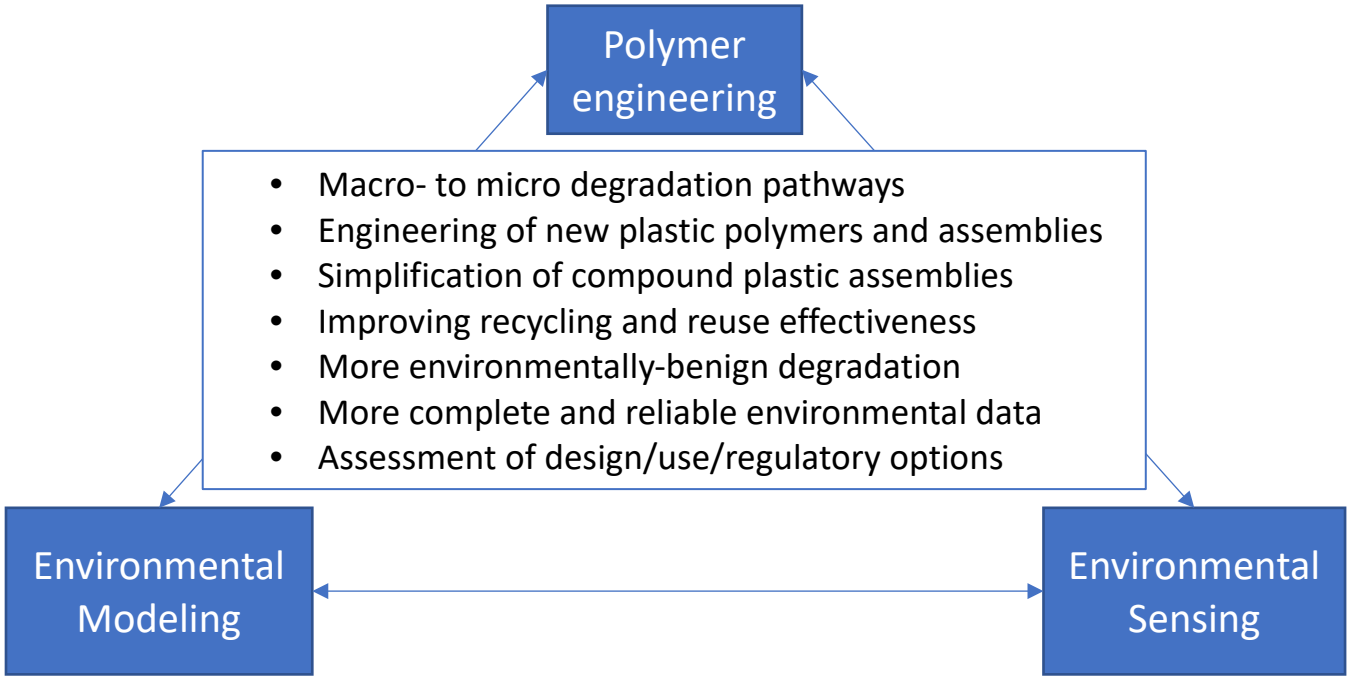
Emphasis on Research, Education, and Convening:

The agenda for ESI-PEP includes all three activity areas of MIT ESI:

1. *Research*: projects are chosen by the ESI-PEP faculty council, with inputs from the Supporting Members. *Industrial sponsorship with commercial IP-licensing rights will be available for appropriate research topics.*
2. *Education*: An important priority for ESI-PEP is our impact on the MIT curriculum and the involvement of undergraduate students through class projects, Undergraduate Research Opportunities (UROP), the MIT Independent Activity Period (IAP), etc.
3. *Convening*: ESI-PEP is planning regular workshops and other events to bring together MIT and outside communities around our agenda and its broader issues.

Multi-disciplinary and systemic agenda:

ESI-PEP is organized around three distinct research areas which are highly inter-dependent and address questions of science, engineering, public policy and consumer behavior:



ESI-PEP Faculty and research topics:

We have assembled a broad cross-section of MIT faculty and their graduate research groups to participate in the ESI-PEP program. The initial committed faculty include:

• Prof. Desirée Plata Civil and Environmental Engineering • Prof. Jeremiah Johnson Chemistry • Prof. Brad Olsen Chemical Engineering • Dr. Brian Anthony Mechanical Engineering and MIT.nano • Prof. Admir Masic Civil and Environmental Engineering	• Prof. Pierre Lermusiaux Mechanical Engineering • Prof. Tom Peacock Environmental Dynamics Laboratory and Mechanical Engineering • Prof. Glenn Flierl Earth, Atmospheric and Planetary Sciences • Prof. John Marshall Earth, Atmospheric and Planetary Sciences

Our research agenda is ambitious and interdisciplinary. Initial research areas include:

1. *Polymer engineering (molecular-level design of new plastics):*

Opportunities exist to engineer modifications of current plastic polymers to promote specific properties, simplify compound assemblies, and enhance degradation pathways and recycling/reuse strategies. Topics include triggered and controlled polyolefin degradation, polymer recycling, biomass polyurethane replacements, material management and reuse processes, simplification of compound plastic assemblies.

2. *Sensing plastics and microplastics in the environment:*

There is still a significant lack of data on the degradation pathways of plastics in their use and disposal environment. The scarcity of data is even more of an issue during the degradation of macro- to micro-plastics and at the micro scale. The lack of data hampers development of more reliable and precise models (our research area #3) and validation of new plastic variants (our research area #1). Topics in this area include multi-scale correlative chemical imaging, Raman microscopy in microfluidic settings, hyperspectral imaging, surface sensing, correlative techniques in complex substrates.

3. *Modeling of plastics and microplastics in the environment:*

Better dispersion and degradation models are required to assess current status, to test new product design variants, and to evaluate and compare potential changes in environmental policies, regulations, recycling approaches and consumer behavior. Topics in this area include plastic transport in air, soil and aquatic environments, optimal path planning for collection methods, 3D (sinking) dynamics, biological interactions, modelling of regulatory options, climatological interactions.

The ESI-PEP faculty have produced White Papers laying out their research agenda. These papers are available to potential Supporting Members upon request.

Partner Institutions:

Collaborative research is an essential aspect of our agenda. Initial partner institutions include:

- Wood Hole Oceanographic Institution (WHOI) and WHOI Microplastics in the Ocean
- Conservation International
- Rozalia Project
- Worldwide Universities Network

Supporting Member participation and benefits:

Supporting membership in ESI-PEP is available to interested organizations and individuals. Membership is through annual renewable gift contributions. Benefits include:

- Regular updates and reports on progress and results of ESI-PEP research projects;
- Opportunities to influence ESI-PEP research agenda and priorities;
- Facilitated introductions to faculty researchers and faculty;
- Engagement opportunities with ESI-PEP graduate students and student-run organizations for internship and employment recruitment;
- Video and face-face ESI-PEP symposia presenting the leading edge of MIT thinking on challenges and solutions to environmental issues;
- Networking opportunities with other Supporting Members and the MIT community;
- Targeted opportunities for Supporting Member commercial companies to sponsor individual ESI-PEP projects with MIT IP commercial licensing rights.

Joining ESI-PEP as a Supporting Member:

For more information, please contact:

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