

MICROFIBERS AND MICROPLASTICS: PURSUING A LIFE-CYCLE APPROACH TO SOLUTIONS

A workshop of the MIT [Environmental Solutions Initiative](#) and [Corporate Relations](#)

Held at MIT on January 17, 2018

Background and motivation for the workshop

Since their invention in the mid-20th century, plastics have become increasingly ubiquitous in the world's materials economy: the volume of [global plastics production surpassed](#) the volume of steel production in the late 1980s. Plastics are the first wholly synthetic material flow introduced into the environment. Production of commodity thermoset and thermoplastics is forecast to continue increasing dramatically with China taking over as the [world's largest producer](#) in 2010. Unintended and undesirable [impacts from plastic pollution](#) have similarly proliferated, and significant concern has emerged about microplastics, typically described as particles less than 5 mm in size.

Workshop summary

The MIT Environmental Solutions Initiative (ESI) and Corporate Relations held a [one-day workshop](#) on January 17, 2018 to bring novel insights from key fields of research at MIT, including materials sciences, civil and environmental engineering, and nanotechnology together with the growing community of stakeholders in microplastic pollution. The two primary purposes of the event were to (1) explore how MIT can contribute to crafting pathways toward solutions to microplastic pollution in particular (and plastic pollution more broadly), and (2) expand collaboration across the plastics "life cycle" [see sidebar at right] among partners in industry, non-profit organizations, foundations, and universities active in microplastics. Brief presentations from veterans in the emerging microplastics community and from MIT researchers set the stage for intensive working group discussions on key topics of interest [see sidebar below right].

Plastics Life-Cycle Stages — in the context of microplastic pollution

- **Materials Design and Manufacture** - how can plastic products be designed and produced to minimize eventual micro- and nano-scale emissions?
- **Use and Maintenance** - how can laundering (and other use) processes and facilities be modified to minimize emissions?
- **Emissions, Disposal, Fate and Transport** - how can micro- and nano-scale emissions be characterized and captured to minimize their ecological and human health impacts?

Overarching themes that emerged during the workshop include:

- Key terms (ie microplastics, microfibers, nanoplastics) are often not used consistently, and research methodologies vary widely. **A common language and greater standardization** (ie of desirable plastic material properties, of unacceptable levels of microplastic particles in specific environments) would foster clearer communication, more effective collaboration across diverse stakeholder groups and life cycle stages, and potentially incentivize investment in new polymer design.
- Microplastic pollution is **"not just a fleece jacket issue."** Much attention has been given in the popular press to the release of microfibers from fleece and other synthetic garments — yet research has not come to consensus regarding what proportion of microplastic pollution is comprised of microfibers, or of what proportion of microfiber pollution is attributable to textiles vs. tires and other sources.
- The values and priorities of **both consumers and businesses** should be considered in identifying and implementing solutions, and **both incentives and regulations** may be useful for engaging these stakeholders.
- It is not immediately clear how best to aid timely information-sharing across the diverse web of stakeholders in microplastics — but it was clear that there was substantial interest in exploring how to do this. One idea was to explore a **platform for a broad 'community of concern'** that would enable interested stakeholders to link easily across sectors and life cycle stages and allow for a centralized and efficient method of accumulating data, ideas, and progress. This would not only help the community itself keep track of headway being made, but could potentially help spread public awareness and action.

Key Topics of Interest

- Material Properties
- Degradation Pathways
- Incentives & Economics
- Sources of Microfibers & Microplastics
- Policy: Partnerships, Communities, Stakeholders, and Human Impact
- Washing & Filtration
- Technology & Attributes for Sensing
- Recycling & Waste



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In summary, the workshop's life cycle approach underscored that there is no single or simple solution to the problems associated with plastic pollution — despite how the issue may be represented in some public discourse. Each stage of the value chain — from how plastic feedstocks are designed, to how they are made into products, to how they are used, to where they end up — hosts opportunities for reducing negative impacts. Solutions will span an enormous range of spatial and temporal strategies — from the nano-scale to the scale of urban waste water treatment plants, from the immediate deployment of consumer-scale capture devices to the longer-term development of new materials and new sensing capabilities. Partnerships among industry, academia, NGOs, and foundations at every stage of the life cycle can contribute to the reduction of microplastics and microfibers in the environment. The collaborative spirit demonstrated at the workshop was essential to sharing knowledge, building momentum, and further developing the portfolio of pathways toward solutions.

Next steps

Moving forward, ESI will foster multi-sectoral engagement for solutions-oriented research and activity at multiple stages in the plastics value chain via three core strategies:

- 1. Sustaining and expanding the workshop community:** Intensive discussion in working groups identified priority issues of shared concern and interest. ESI will aid those groups in refining scoping or position statements that may be used to catalyze specific project identification, further engagement, and funding.
- 2. Actively participating in broader networks:** The workshop identified a role for ESI/MIT in supporting a national or North American network/platform to share and foster coordination of information, research findings, and multi-sector stakeholder organizations across the plastics life cycle, potentially in conjunction with the Outdoor Industry Association's coordinating activities. There may also be some utility in forming a New England or eastern seaboard hub to more strategically complement and partner with emerging concentrations of activity, such as the West Coast and Europe. ESI will survey online platform exemplars and work with workshop participants and the broader network to consider this possibility.
- 3. Pursuing priority research areas:** Major opportunities for MIT research contributions featured at the workshop include (1) polymer science and materials design, and (2) technology development for sensing and characterizing microplastics and how they travel in air, water, soil, and within human beings and other organisms. Additional research opportunities to be investigated include (3) consumer/commercial incentivization, (4) air/water filtration technology, (5) waste reduction/management, and (6) the impact of key variables (composition, ageing, particle size, density, deposition mechanism, etc) on the toxicity and ecological impact of plastic particles.

If you are interested in learning more about partnering with us on the ESI Plastics Program, please send an email to esi-plastics@mit.edu.



[click here to see more photos from the workshop](#)



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