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INNOVATION HIGHLIGHT

Technology in Support of National Security

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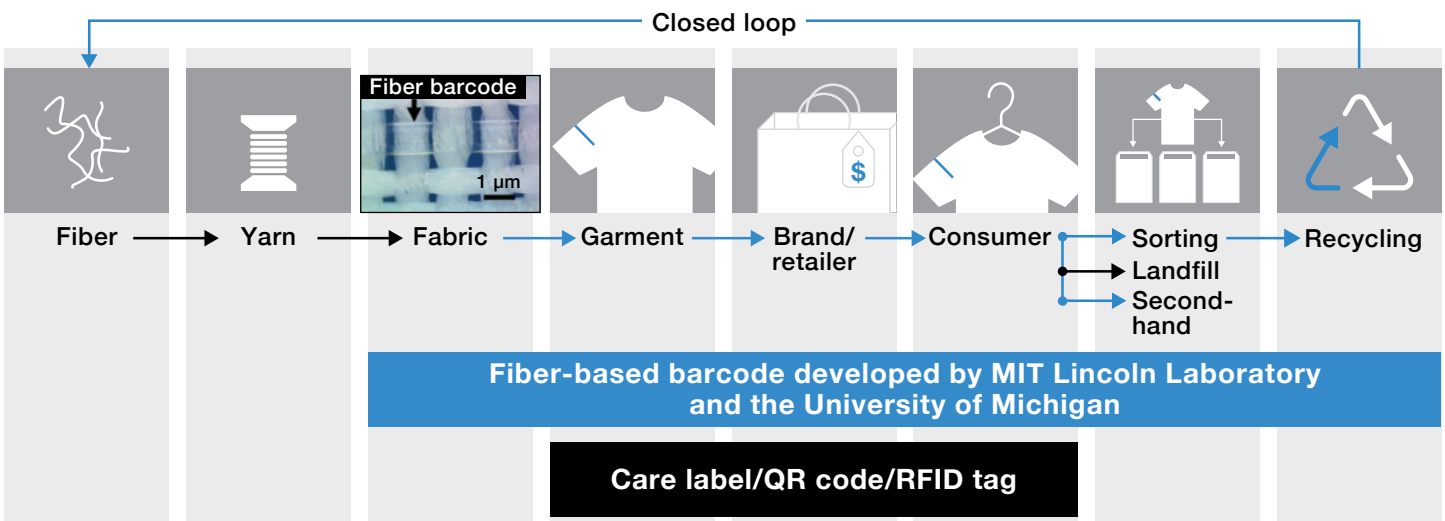
Photonic Fibers Woven into Garments: Durable Barcoded Fabric Tags

Textile supply chain overview and current tracing technologies

Photonic fiber-based barcodes embedded during fabric production would improve recycling efforts because of their extended life cycle **(bright blue bar)**. Care labels, QR codes, and RFID tags added at the garment stage **(black bar)** are typically removed or unreadable after consumer use. DNA and chemicals added to fibers **(orange bar)** are not easily readable by commercial sorting equipment.



When woven into fabrics, all-polymer photonic fibers developed by researchers at Lincoln Laboratory and the University of Michigan can act as "barcodes" to identify and classify the fabrics' component materials. The fibers' reflectance, which is designed to provide a signature of the different components of a fabric, could improve the accuracy of information currently provided on care labels attached to textile products. With better knowledge of a fabric's "ingredients," the recycling industry could appropriately direct the processing of discarded textile items.

KEY FEATURES

- High reliability and rapid readout of textile information even after years of the fabric's normal wear and tear
- Low-cost polymer fibers compatible with existing textile manufacturing processes, enabling a potential market-viable improvement over the standard care label
- Transparency or translucence under ambient light that minimizes adverse aesthetic effects on the fabric

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Motivation

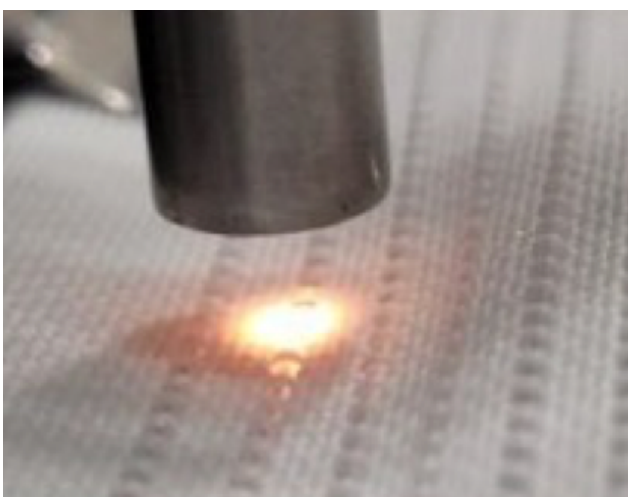
Discarded textile items are a growing waste management burden. According to the United Nations, 92 million tons of textile waste is created worldwide every year, and the Environmental Protection Agency estimates that 16 million tons are generated by Americans. Items like clothing, household linens, and mattresses take up a lot of space in landfills. Incinerating is an inefficient, wasteful, environmentally unsound disposal method.

Recycling textiles has been suggested as an alternative to dumping or burning unwanted goods. The Sorting for Circularity Europe Project—a 16-month analysis of textile disposal in Belgium, Germany, the Netherlands, Poland, Spain, and the United Kingdom—concluded that 74% of low-value, post-consumer textiles is readily available for recycling into new goods.

Yet, very little of the tons of discarded textiles is recycled. One reason is that there is no reliable, easy way to sort through the textiles to determine their potential for recycling. Recyclers need to know what materials are in fabrics before they can direct the fabrics to a suitable reuse. Care tags, ID chips, and even QR codes attached to fabric items have not been goods solutions because they are often inaccurate or become detached from items.

Advanced Fiber Solution

A fiber-based barcode woven directly and unobtrusively into a fabric could be read quickly by conventional spectrometers at automated sorting facilities to close the loop from initial manufacture to reuse. To achieve such a fiber barcode, researchers at Lincoln Laboratory's Defense Fabric Discovery Center and the University of Michigan have engineered photonic fibers whose tailorable periodicity provides optical signatures of a fabric's constituent materials. The development process uses a preform composed of alternating layers of commercially available polymer (i.e., polycarbonate and polymethyl methacrylate) films to thermally draw these layers into micro-fibers with layer thicknesses less than 5 microns. The photonic reflectance and absorption properties of the fibers can be controlled via the draw process to create polymer combinations characteristic of different fabrics.



Measurement of near-infrared spectral response of the photonic fiber integrated into a fabric provides the identity of the materials contained in the fabric.

INTERESTED IN ACCESSING THIS TECHNOLOGY?

Contact the MIT Technology Licensing Office
https://tlo.mit.edu/
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INTERESTED IN WORKING WITH MIT LINCOLN LABORATORY?

https://www.ll.mit.edu/partner-us

Contact the Technology Ventures Office
tvo@ll.mit.edu

PATENT PENDING

More Information

B. Iezzi et al., "Fabric-Integrated Polymeric Photonic Crystal Fibers for Textile Tracing and Sorting," *Advanced Materials Technologies,* 06 February 2023.

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