NSF's Convergence Accelerator

# NSF Convergence Accelerator's 2022 Cohort Phase 1 Award

## Project Title
Economically Sustainable Polypropylene Recycled Plastics Enabled by Compatibilizer Additives

## Awardee
Black & Decker (u.s.) Inc.

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R&D

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## NSF Funded Program
NSF's Convergence Accelerator


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## PROJECT ABSTRACT


Plastics are essential modern materials due to their versatility, low cost, and durability. While they are employed in many industrial sectors, plastic waste generation has presented a major environmental concern; it takes centuries for conventional plastics to degrade naturally. Today, most plastic waste is sent to landfills or incinerated for energy recovery. Mechanical recycling can convert the waste to a potential feedstock, but the quality of recycled resins is crucial for their reuse.

Polypropylene (PP) is a widely used plastic with a low recycling rate. The two challenges of recyling PP are inferior material properties due to contamination and high recycling costs. Since polyethylene (PE) is the most common contaminant in PP recycle streams, PP/PE compatibilizer is a promising approach to improve their properties. However, a scientific understanding of various block copolymers, reactive additives, and processing aids for compatibilizing recycled resins in response to fluctuating post-consumer feedstocks remains challenging. Additionally, a strategy to commercially implement PP compatibilization technologies with competitive cost and desirable properties is not well established.

Black and Decker Inc., in partnership with The University of Akron, envisions improving the quality of PP recycle streams by optimizing the application of compatibilizers using polymer science, process engineering, and machine learning. This project will benefit our partner corporations and the general public through technological development and educational outreach.

This project has multiple goals: (i) to establish the connection between PP/PE ratio, type, and amount of compatibilizer required; (ii) to improve economic viability by developing improved recycled PP compounds; (iii) to create a platform for plastic recycling using automatic control via predictive algorithms to optimize cost and quality; (iv) to develop and implement commercially-viable systems for enhancing performance using current and future generations of compatibilizers.