Background

The presence of pigments in thermoplastic polyurethane (TPU)-based products serves a critical role in enhancing their aesthetic appeal. However, these same pigments pose significant challenges in TPU recycling and upcycling efforts. The large surface areas and Van der Waals forces of pigment particles complicate their separation from the polar TPU matrix in a scalable process. In addition, loss of molecular weight is very common to TPU in most recycling processes, leading to a deterioration in key macroscopic properties such as tensile strength and abrasion resistance. There is a pressing need for an environmentally benign, energy efficient process to separate pigments from post-consumer TPU waste so that the material can be recycled back into the original product or upcycled into higher-value products.

What we're looking for

We are looking for a scalable, ideally continuous process that can efficiently separate different inorganic and organic pigments and dye components from a thermoplastic polyurethane (TPU) matrix. This process should also maintain the basic macroscopic properties of TPU, such as tensile strength and resistance to abrasion.

Solutions of interest include:

- A high throughput separation process, specific for dyes and pigments
- A high throughput separation process, with minimum environmental impact

Our must-have requirements are:

- Eventual solution must be capable of achieving >90% dye removal efficiency (delta E <3).
- For the eventual solution, the recycled TPU must retain >90% of its abrasion resistance and tensile properties.

Our nice-to-have requirements are:

- Process is capable of improving the tensile and abrasion resistance properties of upcycled TPU.
- Solution is capable of achieving 99% removal of pigments.
- Recycled TPU can be recycled multiple times without loss of physical properties

What's out of scope:

- Solvent based recycling process
- Chemical recycling
- Pyrolysis recycling approaches

Acceptable technology readiness levels (TRL): Levels 3-7

1. Basic principles observed
2. Concept development
3. Experimental proof of concept
4. Validated in lab conditions
5. Validated in relevant environment
6. Demonstrated in relevant environment
7. Regulatory approval
8. Product in production
9. Product in market

What we can offer you

Eligible partnership models:

- **Sponsored research**

Benefits:

Sponsored Research

Funding is proposal dependent, but an accepted proposal could expect support in the range of $20,000 - $100,000 (milestone dependent) with the potential for follow on funding.

Facilities and Services

We can offer testing and evaluation of materials and approaches in our labs.

Expertise

Partner will receive guidance over each step of the collaboration. Possibility to develop further collaboration with BASF researchers, based on preliminary results.

Reviewers

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Please contact the University of South Florida Technology Transfer office representative for submission – Karla Schramm at kschramm@usf.edu