



# PET Regrind Recycling for 3D Printing

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## Experiment for Reclaimed PET Tensile Strength and Thermal Analysis

The objective of this experiment is to note the effect of regrind percentage on the tensile strength and thermal properties of laser cut tensile bars. The tensile bars were prepared from a mix of PET Splash 3301 and PET regrind sourced from PET bottles around the RIT campus. The second half of this experiment will require the extrusion of the different regrind percentages and compare the tensile strength and thermal properties.

### INTRODUCTION

- At the Rochester Institute of Technology (RIT), recycling efforts are committed to convert plastic waste into useful products
- One interest shared by many clubs and makerspaces throughout campus is to convert recycled material into 3D Printing filaments
- PET is the most recycled plastic globally and has a 31% recycling rate in the U.S.<sup>1</sup>

### MATERIALS

- PET Splash 3301
- PET Reprint sourced from various soda, juice, and water bottles around the RIT campus

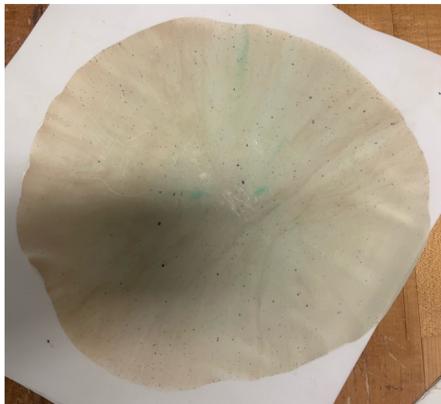
### EQUIPMENT AND PROCESSES

- 1) Reclaimer: Reprint PET bottles
- 2) NOVA Dryer: Drying PET
- 3) Brabender Plasticorder Mixer: Homogenously mix PET
- 4) Carver Bench Top Manual Press: Press sample to even thickness (0.16")
- 5) Fusion Edge Laser Cutter: Cut Type I Tensile Specimen
- 6) Instron 3300 Tensile Tester: Mechanical Analysis
- 7) DSC250: Thermal Analysis

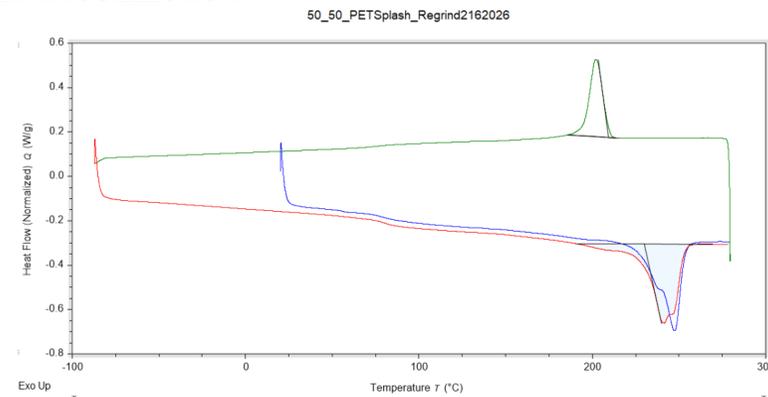


### SAMPLE PREPARATION

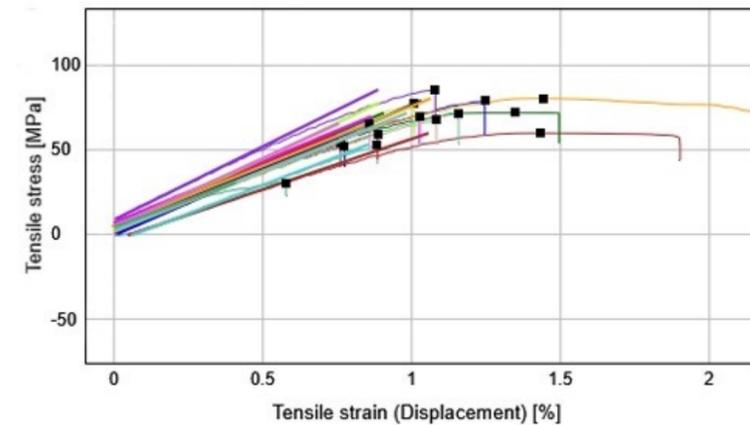
- PET Splash 3301 and PET regrind were dried at 260°C for 4-6 hours
- 50% PET Splash and 50% PET Reprint were mixed at 270°C for 5 minutes at 10 rpm
- Sample was hydraulically pressed at 270°C for 3 minutes at 100 psi
- Procedure repeated for:
  - 80% PET Splash and 20% PET Reprint
  - 100% PET Reprint
- Type I tensile bars were cut using a laser cutter



### DATA COLLECTION



Using DSC250, the cold crystallization and melt enthalpies were determined for PET regrind (20, 50, and 100 wt. %). The graph above shows the 50% PET regrind.



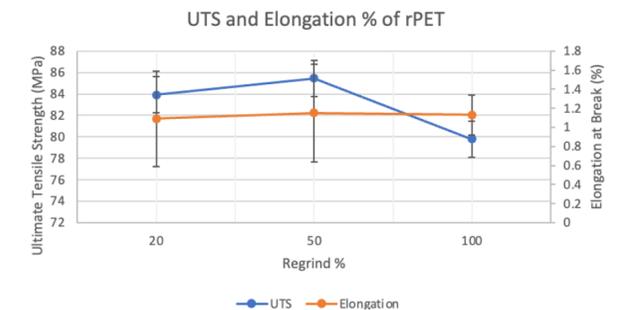
15 samples of each PET regrind (20, 50, and 100 wt. %) were tensile tested to determine ultimate tensile strength. The graph above shows the 50% PET regrind.

### TEST METHODS

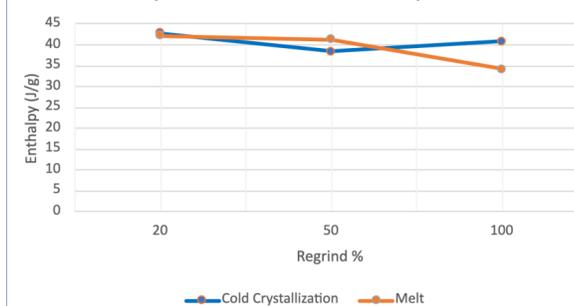
- ASTM D638-22: Standard Test Method for Tensile Properties of Plastics
- DSC250
  - Ramp 10.00°C/min to 280.00°C
  - Ramp 5.00°C/min to -90.00°C
  - Ramp 10.00°C/min to 280.00°C

### INTERPRETATION OF DATA

- The 50% PET regrind was the strongest material tested (85.45 MPa)
- The 100% PET regrind was the weakest (79.8 MPA)
- Elongation increased as regrind amount increased



### Cold Crystallization and Melt Enthalpies of rPET



- 100% PET regrind saw the most percent crystallization (4.75%)
- 20% PET regrind had the lowest temperature for crystallization
- Melt enthalpy remained consistent for 20% and 50% PET regrind but lowered for 100% regrind

### FUTURE WORK

- Extrusion of 20%, 50%, and 100% PET regrind
- Tensile testing of extruded filament

### REFERENCES

<sup>1</sup> Ianelli, Rob. "What Are the Top Plastics That Get Recycled?" *Oceanworks*, 23 Mar. 2022, oceanworks.co/blogs/ocean-plastic-news/what-are-the-top-plastics-that-get-recycled.

### ACKNOWLEDGMENTS

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