Production and Comparison of Re-Extruded Filament From Recycled PET Plastic Bottles for Use in 3D Printing

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With over seven billion pounds of plastic trash globally, the material is abundant, and recycling is vital (UNEP, 2022). A large portion of this waste consists of single-use plastic bottles, often made from polyethylene terephthalate (PET). The PET in these bottles is incredibly versatile and can be recycled with minimal degradation; however, PET still accumulates in landfills and less than thirty percent is recycled (EPA, 2021). Instead, this plastic can be used in 3D printing, a technology that can create useful parts from plastic filament. Unfortunately, most filament extruders on the market cost thousands of dollars and use newly manufactured plastic pellets. A device was constructed to pull a spiralized plastic bottle through a heated nozzle using a motorized spool, forming this plastic into usable filament. Ten meters of filament was formed from each two-liter bottle, which was used to print various parts and quantitative test samples. The visual quality of the parts printed from recycled PET was comparable to those from major filament brands. Another device was constructed to measure the breaking force of standardized plastic samples. The strength of the PET samples was comparable to PLA and more than 1.5 times as strong as PETG and ABS samples. Recycled PET filament produced by the device has qualities comparable to store-bought filament and proves to be a successful, environmentally-friendly alternative. PET filament produced from a wider range of bottles will be compared to a larger selection of popular plastic types using Charpy impact testing for additional data points.

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