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Using Additive Manufacturing Technology in the Design and Production of TPO Based Replacement Floor Mats for an Automotive Vehicle

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TPO is a high use item in most vehicles today. From the seating to the wheels to the floor mats, thermal polyolefin is everywhere. Injection molding is costly and slow. So, what happens when a piece of plastic breaks off or is worn down? Does the vehicle owner go back for replacement parts or do they find a "work around" to replace the missing or defective part. One option is to use additive manufacturing technology to fill the gap. Of all of the components that an automobile has, the constant wear and tear of the floor mat can lead to high replacement costs. For example, women who wear heels and men who were heavy boots, can cause floor mats to tear. In this project, I use additive manufacturing techniques to design and produce a replacement floor mat for an automobile.

THE PROBLEM

Injection molding requires parts to be made weeks in advance before the material can be injected into the mold. This increases the cost and time required to produce the parts. The inconvenience and delay in making a replacement part of a high use items like floor mats in cars can be difficult.

THE SOLUTION

Utilizing additive manufacturing, parts can be made quickly with thermal polyolefins as opposed to using an injection molding machine. FDM/FFM manufacturing uses lasers to create parts and print using thermal polyolefins.

RESEARCH PLAN

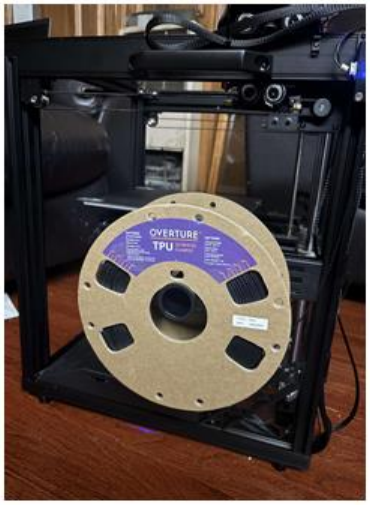
- Understand how additive manufacturing works.
- Understand how thermal plastic fabrication works.
- Understand the chemistry of the materials used to make floor mats.
- Understand the testing of floormats.
- Test out the printed piece's application resistance to water absorption and sediment collection

EXPERIMENTAL SECTION

This part was printed using TPU as a substitute for TPO. It is a 3D model of a floor mat used inside of a vehicle. It has a length of 7 inches and a width of 6.4 inches. It was printed on an Ender 5 S1. The extruder was set to 220°C and the build plate was set to 60°C.

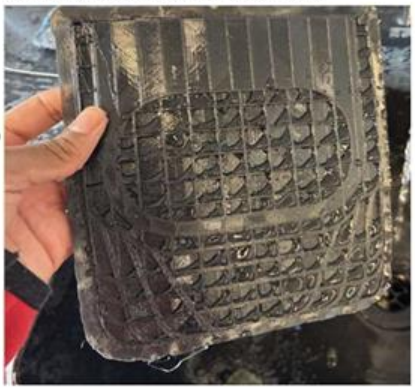
3d printed prototype

3d model of floor mat

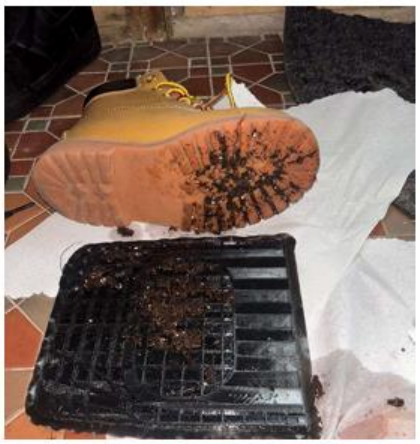


RESULTS

Water resistance:
The water was caught in the ridges of the floormat but did not affect structure or functionality.



Sediment collection:
Wet dirt was placed on a boot and then rubbed on the 3D printed floormat. The floormat was able to collect the majority of the sediment, but some still remained within the boot.:



FUTURE WORK

\Work with more automotive interior parts, test more materials to use for additive manufacturing.

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