How to Recycle and 3D Print with Nalgene Bottles
Plastic Grade: Tritan - Eastman Chemical Company

Nalgene bottles are now a ubiquitous product. Nalgene bottles were originally developed for use in a laboratory, the cross market developed when outdoor enthusiasts started to use the bottles to replace metal and glass containers. The polymer used to make these bottles is a called Tritan. Tritan is a super strong polymer developed by Eastman Chemical Company. Remember the BPA plastic that was previously used in Nalgene bottles? Tritan replaced that, and without the health concerns.In this study we go through the steps of recycling Nalgene bottles into a 3D printed object.

Step 1: Removing Caps

The bottles we purchased had blue caps that needed to be removed and separated from the main bottle section. This blue cap is a different grade of plastic, most likely HDPE. We wanted to only grind and work with the bottom orange part of the bottle. The caps themselves didn't have enough plastic to warrant testing.

Step 2: Grinding

Grinding these bottles was a two step process. In past studies we have had to use two of our industrial grinders to break the bottles down to sizes that our extruders could process. This was the same case for the Nalgene bottles, and we believe this was due to the strength of the Tritan plastic. The first grinder uses a different cutting method then the final grinder that was used. At the end of this step we had enough ground up bottles to move onto extrusion, 18 bottles total were ground up.

Step 3: Filament Making

We had worked with Tritan in the past and we were confident that we would have a successful time extruding this material. We were right - Tritan extruded very well. We easily dialed-in filament with a tolerance of +/-0.05mm. The settings that follow were used during the extrusion step.

- Filabot EX6 - 1.8mm nozzle with melt filter, temperatures set at 220ºC Front Zone, 225ºC Middle Zone, 210ºC Rear Zone, 40ºC Feed Zone
- Filabot Airpath - Two of these were used because we can run this material very fast, this would have worked with one at a slower extrusion rate.
- Filabot Spooler - A standard setup with an upgraded Filameasure laser measuring and recording addon.

Step 4: Test Print

The color of the filament was very catchy, creating anticipation to see what the material looked like as a printed part. The hot end temperature was 240°C, with the bed set at 100°C. The bed setup used kapton tape with ABS slurry. The test print came out very well, and we needed minimal changes to the print settings.

Step 5: Final Print

For the final print nothing could be more fitting then a splash guard for a wide mouth Nalgene. It is a little ironic that the bottles used to make this print were the narrow mouth design. The print came out great with no clean up needed, other then removing the glue from the bottom layer. We should also add that a chain was printed to highlight the strength of the polymer.