Characterization of Trace Impurities in 3D Printed Recycled ABS Materials

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Abstract

The effects of recycling on the composition and mechanical behavior of 3D printed acrylonitrile-butadiene-styrene (ABS) materials were evaluated to elucidate the fundamental structure-property relationships that influence the recyclability of a polymeric material. In this study, a series of recycled ABS filaments were prepared in an iterative process wherein the as-received filament was shredded into granulate material, extruded into new filament and then 3D printing into specimens. This process was repeated two more times to create thrice recycled materials, which were characterized in terms using a variety of analytical tools including XRF. Wavelength dispersive XRF experiments demonstrate that trace metals are generated during the shredding process, resulting in increased Fe, Ti and S concentrations. Interestingly, the mechanical and thermal properties of the recycled materials remain very similar despite the introduction of these impurities. The results suggest that 3D printing of recycled plastics is a viable option generating the next generation of customizable recycled materials. Furthermore, XRF is an excellent tool for evaluating the change in composition of such materials.