Forming and formability of 3D printed thermoplastics

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The suitability of forming operations for enhancing the mechanical properties and functionality of 3D-printed thermoplastic parts was studied and analyzed. Parts were made with fused filament fabrication 3D-printer. Materials used were common PLA and ABS plastics. Polymide CoPA (nylon 6/6,6) was also tested as one of the less used materials on this printer type. Different joints and geometries were made using thermoforming for 3D-printed plastic parts. Joint to metal was done using geometrical shape to lock it in place. Two hinges were made, one by directly 3D-printing and other by thermoforming 3D-printed parts. This allowed comparison between manufacturability, function and strength of the parts. A device was made to test utility and integrity of 3D-printed part trough repeated heating and forming. Strength between directly 3D-printed geometry and formed geometry was also tested using a tensile test machine and three-point bending. Result showed that functionality and strength of the 3D-printed parts can be improved in some cases. Formability varied between materials and geometries. PLA benefitted most from thermoforming while ABS had best improvement in strength. 3D-printed plastic can be thermoformed to further expand possibilities in manufacturing of AM parts.