

Abstract

Polypropylene (PP) is semi crystalline in nature and therefore undergoes shrinkage. Using unfilled PP as a filament for FFF is not viable due to its dimensional instability occurring during and after printing of the product. In order to achieve printable parts, it is crucial to reduce the material's tendency to warp, as well as to improve the filament's mechanical and flow properties, and its elasticity. Thus, it is essential to fill and blend PP with spherical fillers and amorphous materials. In this work the main focus lies on the formation of PP compounds consisting of two types of spherical solid glass beads in different sizes. The addition of 30 vol.-% of fillers, independent to the filler size, showed a strong reduction in the material's shrinkage, without changing the degree of crystallinity of the compounds. The inorganic boro-silicate glass type revealed far better mechanical properties, as well as a drastic increase in crystallization temperature, a more even filler distribution and a better compatibility to the polymer, compared to the inorganic soda lime glass. The mechanical properties of the most promising compounds were optimized for 3D printing by means of melt blending with three different amorphous polymers. Best results were achieved with amorphous polyolefin, which compound was possible to extrude in a good quality in a big scale. The printing of this compound revealed a drastic improvement in warpage compared to unfilled PP.