ABSTRACT

So far, Fused Filament Fabrication (FFF) has demonstrated its ability to print the part with MMAM approach by using one or two separate nozzles to extrude the materials simultaneously. Therefore, a multi-material part with wide range of properties can be obtained. However, the bonding strength between these two materials has been recognized as the major limitation of this technology. Recently, several studies have offered some strategies to solve this problem, such as by adjusting the material configurations or optimizing the parameters.

The current study presents the mechanical properties of printed parts that were composed by PLA and TPU materials which arranged in a sandwich-like structure. The influences of various raster angles and the number of layer stack materials on PLA/TPU printed parts were examined in terms of their flexural properties and failure characteristics. In addition, the characteristic of melt viscosity of PLA and TPU materials was also determined.

The results showed that the flexural strength and modulus of the printed parts decreased with the greater raster inclination. In addition, it was demonstrated interlocking between the adjacent crossed raster could increase the flexural strength of the printed parts. On the other hand, greater stack of material layers could adversely impact the flexural strength of the printed parts. Besides, imbalance stress distribution across the flexural cross-section of the printed part decreased the flexural strength almost twice. However, the influences of material configurations can be contrasted at different raster orientations. In the end, raster angles and material configurations obviously affect the flexural properties of PLA/TPU printed parts significantly.

Keywords: Fused Filament Fabrication (FFF), PLA, TPU, raster angle, sandwich-like structure