

Production of PLA-Milled Carbon Fibers (MCF) filled filaments for Fused Filament Fabrication (FFF) printing

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Abstract.

Fused Filament Fabrication (FFF) printing is easy to manage but it is known that its parts have lower properties than the equivalent parts obtained by conventional methods, such as injection molding, since they are characterized by voids and weak interlaminar bonds [1].

One way to overcome this aspect is to introduce reinforcing fillers into the polymer matrix of the filament, in the form of fibers or nanomaterials. FFF filaments loaded with carbon fibers (CF) are particularly interesting for their use in the automotive, robots, drones, prosthetics and orthotics fields. One of the most popular polymers in FFF printing is Polylactic Acid (PLA), as it is relatively easy to print and safe to use. Some authors [2] obtained filler percentages up to 20wt% of carbon nano powder (NC) having dimensions of about 500nm, with a modest increase in the observed mechanical properties, as well as in the electrical ones.

The present work aims to produce PLA filaments with a high charge of milled carbon fibers (MCF, average length of 1000nm), which can be used as feedstock in FFF printing.

The mechanical specimens were printed up to 30wt% of MCF and showed a significant improvement in mechanical properties. DSC and rheology tests were also performed to unveil the behaviour of the extruded filaments. Finally, a comparative analysis with other filaments on the market confirmed the good properties found in this work.

References

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- [2] S. Kumar et al. International Journal of Nanoscience. 2019, 18, 05.