Workshop « Soft Material Models »

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Study of the printing parameters' effect on the impact strength of FDM-built parts

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Abstract

The aim of this work is to study the influence of printing parameters on the impact strength of parts obtained through the additive manufacturing process known as Fused Deposition Modeling (FDM). Three parameters of the FDM process, namely layer thickness, infill density and infill pattern, are selected to investigate their effects on the impact strength of the parts. This study focuses on two types of polymers: PLA and PETG and is based on the implementation of a Design of Experiments (DoE). It has been demonstrated that the aforementioned three parameters have significant influences on the resilience of parts manufactured by FDM. Furthermore, this study has enabled the determination of optimal printing parameters, which result in higher impact strength compared to the parameters set by the machine manufacturer.

Keywords: Impact strength, FDM, PLA, PETG, Design of Experiments.

Experimental protocol

Design of Experiments

DoE is adopted with three factors and three levels (Taguchi L9 table). The choice of parameters and their levels was based on recent bibliographic works [1,2].

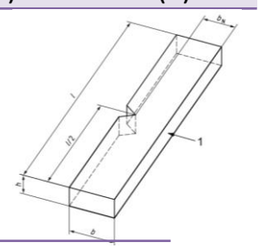
Parameters levels

Parameter	Level 1	Level 2	Level 3
Layer height (mm)	0.2	0.3	0.4
Infill density (%)	50%	75%	100%
Infill pattern	Grid (G)	Honeycomb (N)	Triangular (T)

Normalized Samples

ISO 179

Sample geometry and dimensions [3]



l (mm)	b (mm)	h (mm)	b_N (mm)
80 ± 2	10 ± 0.2	4 ± 0.2	8 ± 0.2

Manufacturing and Test Machines

Volumic Stream 30 Pro MK2 FDM

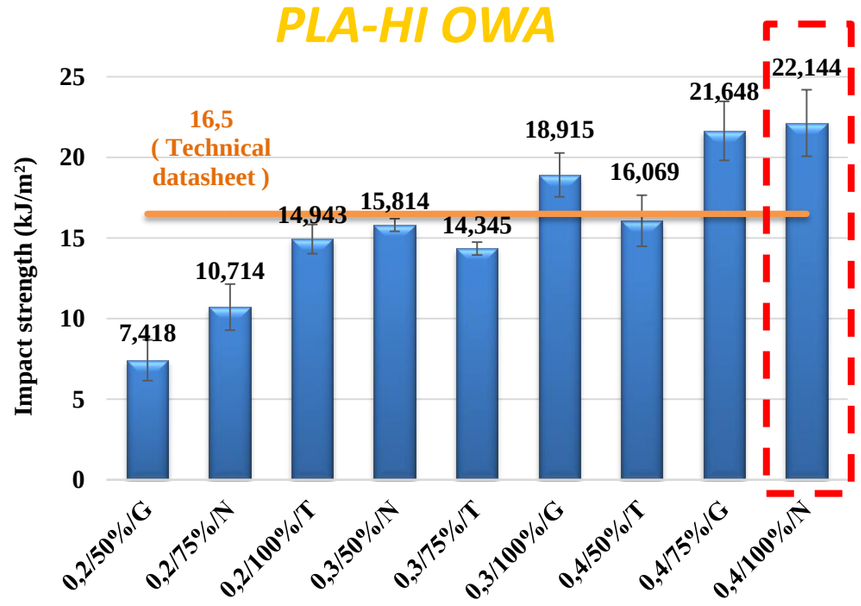
Charpy impact test machine XJL-50D LCD

Broken Charpy P LA samples

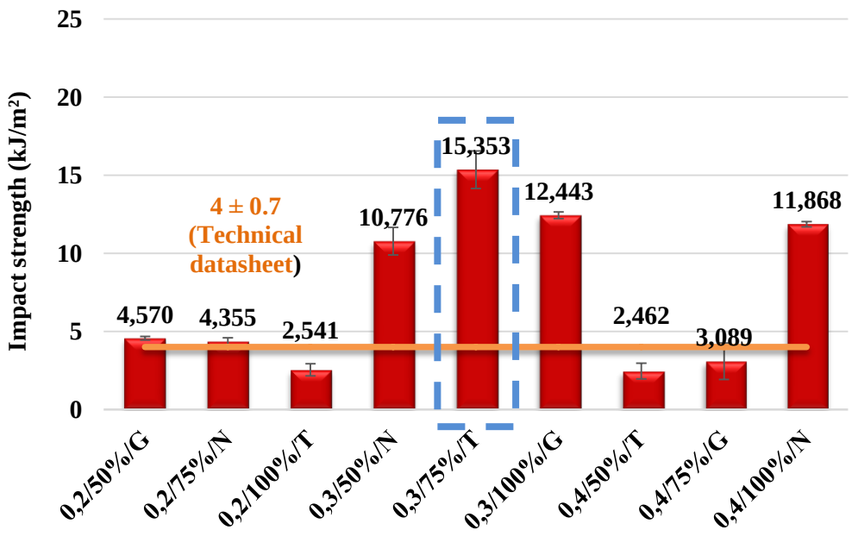
Broken Charpy PETG samples

Results

PLA-HI OWA



PETG Ultra Volumic



Conclusion

Optimal combinations of parameters that provide the highest impact strength

PLA	0,4 / 100% / Nid d'abeille
PETG	0,3 / 75% / Triangulaire

References

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