3D printed textile-like structures: materials, textures and challenges

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Abstract: The utilization of additive technologies facilitates the production of intricately structured objects. However, when it comes to prototyping traditional textiles, there exist numerous challenges that require resolution. The presented work explores the fused filament fabrication (FFF) method, which enables the creation of textile-like structures with properties that can significantly vary based on the polymer (filament) utilized. The study not only considers the materials themselves but also encompasses the printing parameters and modifications to the 3D printer. The objective of this research is to investigate 3D printed structures made from various materials (filaments), conduct a comparative analysis, and to furnish forthcoming researchers with an exhaustive comprehension and a substantial dataset regarding the efficacy of these structures as 3D textiles. It is important to highlight that the inherent attributes of the materials, as well as their behavior within 3D printed structures, are critical considerations that can exhibit substantial variations based on filament thickness, printed layer thickness, internal geometry of the model, and operational conditions. Furthermore, the research also explores the testing of composite materials in addition to mono-materials, with the aim of enhancing the natural properties of the base material or enabling programmability in the utilization of such structures as smart textiles. Emphasis is placed on refining 3D printing technology, particularly on optimizing settings to enhance detailing and the quality of the initial layer print, crucial for achieving the desired quality and flexibility in 3D fabric structures. To conclude, the study addresses key challenges related to prior endeavors in achieving "textile" qualities in 3D printed structures, while also proposing novel ideas for their resolution.

Keywords: *3d printed textile, smart textile, composite structures, sustainability.*

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