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标题: 3D Printing of Bioinspired Structural Materials with Fibers Induced by Doctor Blading Process

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摘要: Fiber is a crucial element in biological micro-structural materials. Replication of fiber-reinforced composites with analogous architectures of their natural counterparts has caused widespread academic concern. Recent researches indicate 3D printing technology has the potential to produce biomimetic structural materials. The aim of this study is to develop a process to fabricate fiber-reinforced composites with ordered yet spatially tunable fiber arrangement. Specifically, we present a method to align fibers during the 3D printing of fiber-reinforced composites. A modified slurry-based stereolithography process was developed, and the fibers in the fiber-resin mixture were aligned by Shear force produced during the spreading of slurry. We investigated the influence of relative factors on fiber orientation, and two models were used to uncover the internal mechanism. By controlling the speed and the direction of the moving blade, the patterns that fibers were arranged can be freely programmed Therefore, we have extracted bioinspired sinusoidal and zigzag design motifs to analyze their mechanical properties compared with non-bioinspired motifs. The proposed method is relatively material agnostic, more efficient and more facile. It thus provides a promising route to fabricate fiber-reinforced composites, and has potential to be adopted in biological structures researches and industrial applications.

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