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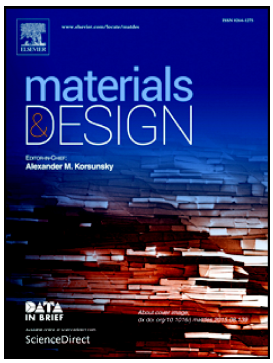

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Surface tailoring and design-driven prototyping of fabrics with 3D-printing: an all-cellulose approach

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Abstract

In this work, we present a new all-cellulose approach for modifying and functionalizing textiles. The use of 3D-printing and two acetylated cellulose derivatives, rigid cellulose acetate (CA) and flexible acetoxypropyl cellulose (APC), on cellulosic fabrics were studied. In addition, prototypes were generated using a design-driven approach. The interactions of cellulose derivatives with cellulose were assessed by quartz crystal microbalance with dissipation monitoring (QCM-D). 3D-printing of cellulosic materials on cellulosic fabrics was performed using a direct-write method by printing cellulose derivatives on woven and knitted cotton and woven viscose fabrics. The adhesion of the printed structures was evaluated via peeling and washability tests. The results indicated that although both cellulose derivatives had a positive attraction towards the cellulose substrate, CA had higher affinity and good adhesion properties, whereas the more branched molecular structure of APC was less firmly attached to cellulosic material. The applicability of 3D-printing cellulosic materials for textile modification and functionalization was assessed through iterative prototyping. Visual effects and functional surface structures were demonstrated. Utilization of 3D-printing of cellulosic materials for surface tailoring of cellulosic textiles, eliminates labour intensive processing or external glues and may enable new and simple customization processes with minimized material usage.

Keywords: 3D-printing, cellulose derivatives, cellulose acetate, acetoxypropyl cellulose, design-driven, prototyping