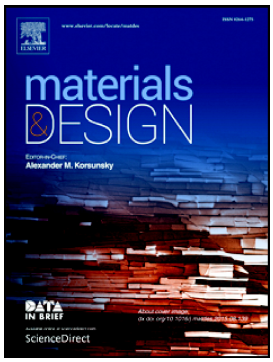

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Preparation of poly (vinyl alcohol)/ionic liquid composites with improved processability and electrical conductivity for fused deposition modeling

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Abstract:

This work aims to realize the fused deposition modeling (FDM) process of poly (vinyl alcohol) (PVA), which is a multi-hydroxyl polymer with good comprehensive properties. However, achieving the FDM process for PVA is quite challenging due to its narrow thermal processing window. To address this problem, an ionic liquid (IL) was introduced to improve the thermal processability of PVA. The materials, the FDM process and properties of the FDM products were systematically evaluated. The results indicated that the PVA/IL composites exhibited significantly improved thermal processing properties. The PVA/IL filament prepared with a suitable viscosity and modulus ratio showed good printability. The tensile strength of the FDM parts increased from 8.7MPa to 13.6MPa due to the difference in the interlayer bond strength when the nozzle temperatures ranged from 170 °C to 200 °C. The zero shear rate viscosity, the relaxation time and the surface tension at different printing temperatures were analyzed and provide theoretical insight into the diffusion of polymer chains at the interface during the FDM process. Interestingly, the 3D printed composites were flexible and exhibited tailored electrical conductivity with a strong dependence on the printing temperature, revealing the potential to be functional parts in the field of flexible electronics.

Keywords: Poly (vinyl alcohol); Ionic liquid; Fused deposition modeling; Interfacial bonding; Zero

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