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Experimental study of the residue film in direct gravure printing of electronics RUNGROT KITSOMBOONLOHA, UMUT CEYHAN, S.J.S. MORRIS, VIVEK SUBRAMANIAN, University of California, Berkeley — Direct gravure printing is a promising candidate for high resolution printing of electronics. During gravure printing, excess ink is removed from a patterned plate by a doctor blade and a residue film ∼10nm thick is left on the non-patterned area. This residue film degrades the pattern fidelity and has to be minimized. To understand the issues involved, we performed experiments on this residue film using a custom printer. We investigated the effects of wettability, ink viscosity and printing speed to understand the mechanisms of residue film formation. The results reveal that there are two types of residue film, originating from the wettability of the printing components and elastohydrodynamics. The first is a cell-dependent residue film, produced by the doctor blade dragging ink out from engraved cells. The second is a uniform residue film, which is caused by an increase in the gap between the patterned plate and doctor blade due to elastohydrodynamic pressure. As the capillary number increases, the cell-dependent residue film decreases, while the uniform residue film increases. These two types of residue films force gravure printing to be operated within a regime covering carefully controlled wettability, ink viscosity and printing speed, where the residue film is minimized.

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