Fluid mechanical proximity effects in high-resolution gravure printing for printed electronics\textsuperscript{1} GERD GRAU, York University, WILLIAM J. SCHEIDELER, VIVEK SUBRAMANIAN, University of California, Berkeley — Gravure printing is a very promising method for printed electronics because it combines high throughput with high resolution. Recently, printed lines with 2 micrometer resolution have been demonstrated at printing speeds on the order of 1m/s. In order to build realistic circuits, the fluid dynamics of complex pattern formation needs to be studied. Recently, we showed that highly-scaled lines printed in close succession exhibit proximity effects that can either improve or deteriorate print quality depending on a number of parameters. It was found that this effect occurs if cells are connected by a thin fluid film. Here, we present further experimental and modeling results explaining the mechanism by which this thin fluid film affects pattern formation. During the transfer of ink from the roll to the substrate, ink can flow in between connected cells. Asymmetry in the fluid distribution created by the preceding doctor blade wiping process results in net fluid flow from cells that transfer first to cells that transfer subsequently. The proximity of these cells thus affects the final ink distribution on the substrate, which is critically important to understand and design optimally when printing highly-scaled patterns of electronic materials.

\textsuperscript{1}This work is based upon work supported in part by the National Science Foundation under Cooperative Agreement No. EEC-1160494.

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Date submitted: 30 Jul 2016

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