

Optimization of Aerosol Jet Printing for High Resolution, High Aspect Ratio Silver Lines

Ankit Mahajan, C. Daniel Frisbie, and Lorraine F. Francis

Department of Chemical Engineering and Materials Science
University of Minnesota, Minneapolis, Minnesota 55455

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Aerosol Jet Printing is a recent technology that can produce feature sizes smaller than traditional printing processes such as inkjet, flexography or screen printing. In this method, an ink is converted into a fine mist using an ultrasonic nebulizer. The mist is then transported to the printhead using a flowing carrier gas. On exit from the print nozzle, a sheath gas focusses the mist to produce a high resolution printed pattern. The geometry of the printed features is governed by a variety of process variables such as the flow rates of the carrier and the sheath gas respectively, and the stage speed. A systematic study of process conditions reveals a key parameter: the ratio of the sheath gas flow rate to the carrier gas flow rate, defined here as the focusing ratio. Focusing ratio alone determines the width and height of a printed feature, so long as the stage speed is constant. The results are condensed into a simplified process map, which serves as a guideline to estimate the geometry of the printed lines for a given set of the process variables. Furthermore, these results are also applicable to other material systems such as semiconductor and dielectric inks.

Reference: Mahajan, A.; Frisbie, C. D.; Francis, L. F. ACS Appl. Mater. Interfaces **2013**, 5, 4856–4864