Using a micro-fabricated silicon printhead, we developed a novel printing technique, molecular jet printing (MoJet) [1-2] that allows direct patterning of small molecular weight organics and metals by additive deposition at high resolution. Today’s dominant method for patterning vacuum-deposited semiconducting molecular organics uses a thin metal stencil as a shadow mask through which material evaporates. Once the metal stencil is fabricated, it cannot be reconfigured to define arbitrary patterns or be scaled up with substrate size. In contrast, the MoJet printing technique utilizes a silicon printhead that integrates a moving micro-shutter with a micro-aperture. The shutter can be opened or closed with a DC control signal. Evaporated organic molecules can either pass through the aperture to reach the substrate when no bias is applied or be obstructed by the shutter when the control signal is above 30 V DC. This reconfigurable printhead together with a moving stage allows arbitrary patterning capability and scalability of the MoJet printer to larger substrate sizes.

We demonstrate that active organic devices such as organic LEDs and organic FETs (see graphics below) can be fabricated directly using the MoJet printer. The MoJet printing is a solvent-free process (in contrast to ink-jet printing) that combines the high quality of thermally evaporated thin films with the high precision and scalability enabled by MEMS technology. The MoJet printed organic electronic devices have the same performance characteristics as those defined by the shadow-mask patterning method, but the size of the substrate plate can now be expanded beyond GEN 2/3. As such, the MoJet printer surpasses the capability of the metal-stencil shadow mask and has the potential to become the next generation patterning tool for making organic optoelectronic devices.

**REFERENCES**
