

## INTRODUCTION

Surface patterning tools (SPT™ print cartridges) are the “ink cartridges” for the Nano eNabler™ system. They create an environment for precise fluidic sample handling. SPT™ print cartridges can be considered to be the analog of the disposable print cartridge for a desktop printer, except that they may contain a vast spectrum of inks, including proteins, nucleic acids, chemicals, etchants, colloids, quantum dots, and other molecules. SPT™ print cartridges can be designed to accommodate a variety of needs. The basic structure of an SPT™ print cartridge is a microcantilever liquid dispenser and a sample loading reservoir, which are connected by a microchannel. The geometric details, chemical characteristics and number of cantilevers can be altered according to sample type, sample volume, spot size and throughput requirements. SPT™ print cartridges can have either a single cantilever for delivering one type of fluid or multiple cantilevers for delivering multiple fluidic samples. The spot size can be varied in the range from 1 μm to 30 μm [1,2]. Since the material used to construct SPT™ print cartridges is SiO<sub>2</sub>, it is compatible with biomaterials and resistant to many chemicals.

## DATA SUMMARY

Figure 1 shows bright field micrographs of two different SPT designs. The left panel shows a single cantilever SPT™ print cartridge, the right panel shows a six cantilever SPT™ print cartridge. The six reservoirs on the single cantilever SPT™ print cartridge substrate each connects to only one cantilever and only one cantilever is used at a time. This facilitates rapid cantilever swapping. The six cantilever SPT™ print cartridge has six reservoirs, each of which is connected to one of the six cantilevers through a channel network. With this SPT™ print cartridge, six different samples can be loaded and printed simultaneously. Figure 2 shows fluorescent images demonstrating loading and printing with a six cantilever SPT™ print cartridge. The red color indicates a Texas Red®-labeled protein, and the green color indicates a Cy™2-labeled protein. There is no cross contamination between loading channels and cantilevers. The lower right image shows a large multiplexed array containing over 1000 spots, which was generated using the six cantilever SPT™ print cartridge shown. The inset image shows a 6X6 multiplexed array. The spot size is 10 μm and the

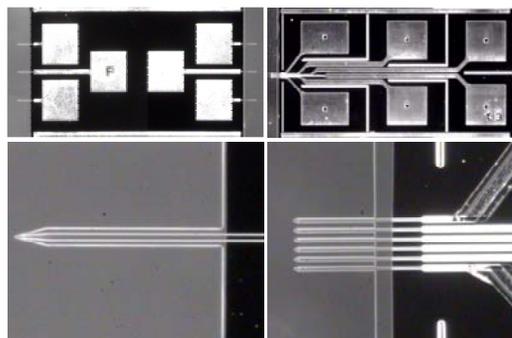


Figure 1. Bright field images of two SPT designs.

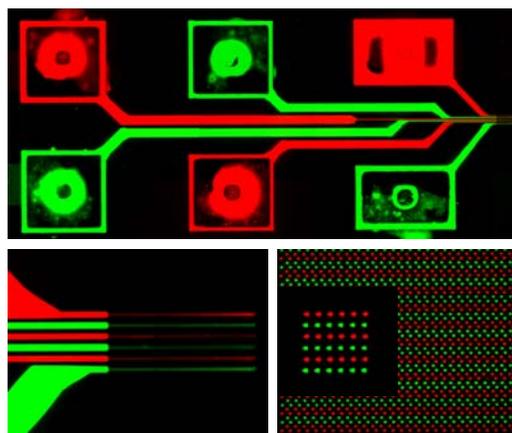


Figure 2. Multichannel SPT™ print cartridge and resulting spot pattern.

spacing is 20 μm. We have also used these SPT™ print cartridges to deliver non-biological materials such as gold etchant, NaCl salt solution, Fe<sub>2</sub>O<sub>3</sub> nanoparticles, gold colloids, and quantum dots.

## CONCLUSIONS

Applying different SPT™ print cartridge designs, the Nano eNabler™ system can efficiently generate both single and multiplexed arrays. A broad range of both biological and non-biological materials can be loaded, positioned and patterned accurately on surfaces using the Nano eNabler™ system.

## REFERENCES

- [1] Xu, J., Lynch, M., Huff, J., Mosher, C., Vengasandra, S., Ding, G., and E. Henderson. Microfabricated quill-type surface patterning tools for the creation of biological micro/nano arrays. *Biomedical Microdevices* 6 (2): 117-123, 2004.
- [2] Xu, J., Lynch, M., Nettikadan, S., Mosher, C., Vengasandra, S., and E. Henderson. Micromachined biomolecular ink cartridges — Surface patterning tools for the printing of multiplexed biomolecular arrays. *Sensors & Actuators B: Chemical*, 2005, in press.