INTRODUCTION

Surface Patterning Tools (SPTs) are the “ink cartridges” for the NanoArrayer™ system. They create an environment for precise fluidic sample handling. SPTs 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. SPTs can be designed to accommodate a variety of needs. The basic structure of an SPT 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. SPTs 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 SPTs is SiO$_2$, 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, the right panel shows a six cantilever SPT. The six reservoirs on the single cantilever SPT 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 has six reservoirs, each of which is connected to one of the six cantilevers through a channel network. With this SPT six different samples can be loaded and printed simultaneously. Figure 2 shows fluorescent images demonstrating loading and printing with a six cantilever SPT. 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 shown. The inset image shows a 6X6 multiplexed array. The spot size is 10 µm and the spacing is 20 µm. We have also used these SPTs to deliver non-biological materials such as gold etchant, NaCl salt solution, Fe$_3$O$_4$ nanoparticles, gold colloids, and quantum dots.

CONCLUSIONS

Applying different SPT designs, the NanoArrayer 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 NanoArrayer™ system.

REFERENCES