Abstract to EIPBN 07

NanoContact Printing Using a Stamp Fabricated by UV Nanoimprint Lithography

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Contact printing has many applications including flexible electronics, biosensors, catalytic surfaces, and cell biology.[1] Stamp is a critical component in contact printing. Original contact printing used a soft-PDMS stamp, which is capable of printing microscale patterns (μCP), but not nanoscale patterns (nCP) due to mechanical strength induced defects of the soft-PDMS. Since then, different stamp materials and structures have been proposed towards nanoscale printing for different applications, such as hard-PDMS, HSQ, flexible or rigid back supports etc. In this work, we use a stamp fabricated by UV nanoimprint lithography with a thin elastic layer *and* a thin rigid back support. The thin elastic layer is expected to reduce stamp distortion during printing; the rigid back support offers mechanical strength of the stamp for less in-plane distortion; and the thin thickness of rigid support allows low pressure printing, which is important in decreasing stamp/substrate deformation for reduced distortion and stamp protection.

The detailed fabrication process is as follows: a Si master with pillar arrays of 160-nm-depth and feature/pitch as small as 50/150 nm is fabricated by EBL, Cr evaporation, liftoff and dry etching; nCP stamp with the same features as on the master is fabricated by double UV nanoimprint using Nanonex 2010 UV resist (180-nm-thick) with an underlayer (200-nm-thick) on a thin cover glass (150-μm-thick) (Fig. 1a); then nCP is carried out on a SiO_2/Si wafer in a gas-pressed UV-imprint chamber with a pressure of 40-80 psi and time of 1-30 min. Different chemistries have been demonstrated by nCP and nanoarrays are characterized by fluorescence microscopy and atomic force microscopy (AFM).

Fig. 1b shows a SEM picture of 50/150 nm array after Cr liftoff on Si master. Fig. 1c shows an AFM image of 50/250 nm array on nCP stamp. Fig. 2a shows confocal fluorescence image of FITC arrays with different feature/pitch sizes printed on aminosilane treated substrate; fig. 2b-c show AFM images of 50 nm and 200 nm feature streptavidin protein arrays with an uniform thickness of 3 nm fabricated by printing NHS-biotin on the aminosilane treated substrate followed by biotin-streptavidin interaction. Stamp feature aspect ratio, durability, printing pressure, potential for multilayer printing and surface chemistry will be discussed.

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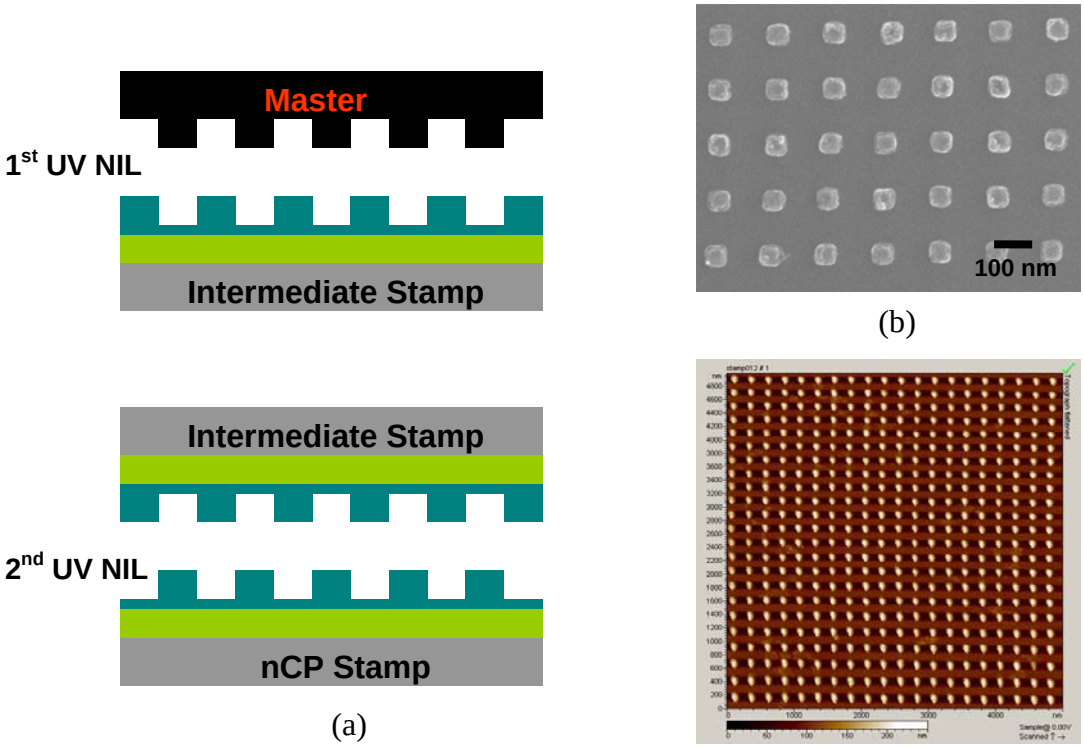
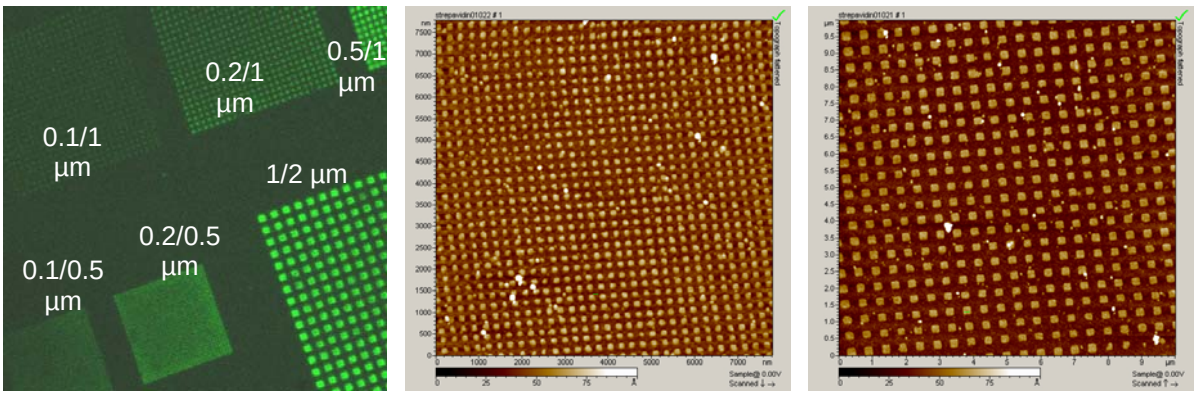
[1]A. P. Quist, E. Pavlovic, S. Oscarsson, Anal. Bioanal. Chem. **381**, 591 (2005)



(a) (b) (c)

Figure 1 a) Schematics of nCP stamp fabrication by double UV nanoimprint; b) SEM image of 50/150 nm array after Cr liftoff on Si mater; AFM image of 50/250 nm array on nCP stamp.



(a) (b) (c)

Figure 2 a) Confocal fluorescence image of FITC arrays of different feature/pitch sizes; b-c) AFM images of 50/250 nm and 200/500 nm streptavidin protein arrays by nCP.