Silicon Microarray™ Technology

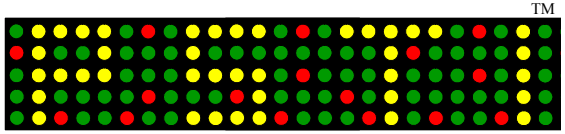
The New Standard for the Fabrication of High Precision DNA and Protein Microarrays

Ultra high precision micromachining capabilities and the unique physical properties of single crystal silicon have been combined to create a microcontact printing technology that delivers the highest quality printed spots at the lowest cost available. This technology will allow practitioners of microcontact printing to perform more accurate experiments, at a faster rate and at a fraction of the current costs. Other applications besides fabricating DNA and protein microarrays include precise, small volume fluid delivery and the printing of whole cells, inorganic materials, hot melt adhesives, solder, etc.

Silicon Pins: Micromachined Si pins with various tip sizes capable of printing 50-350µm spots.

Silicon Printhead: Printheads capable of accommodating up to 32, 48 pins on a 384 SBS format or up to 128, 192 pins on a 1536 SBS format are available.

Printhead Adapter: Printhead adapters can be easily supplied to adapt the silicon pins and printhead to any microarray spotter.



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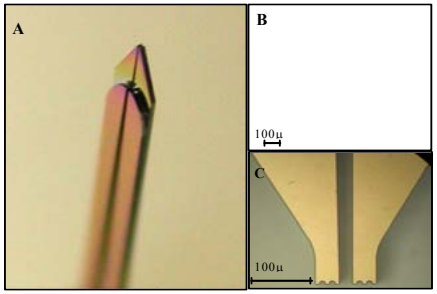
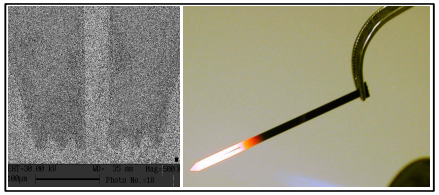
Advantages

1. All pins are precisely identical for the highest precision and pin-to-pin uniformity
2. Low Cost: approximately 25% the cost of the current premium printing technologies
3. Greatly reduced carryover due to more wash-accessible reservoir and slot
4. Greatly reduced prespotting phenomena
5. Print tip sizes ranging from 50x50 to 200x200µm
6. No tip deterioration such as bending, blunting or mushrooming
7. The pins print to dryness using the entire sample taken up. Print volumes of less than 250pL per spot (~ 450 spots per 100nL sample uptake)
8. Ability to completely pickup the sample from the source plate (the last few microliters)
9. Ability to directly use 96, 384 or 1536 source plates
10. Highly precise volumetric uptake (25-250nL per dip)
11. Non-flat tip texturing provides highly uniform printed spots
12. Super elasticity of silicon provides 100% recovery from stresses below the breakage point
13. Ability to chemically modify the pin surface, which is SiO_2
14. Readily adaptable to any microarray spotting system

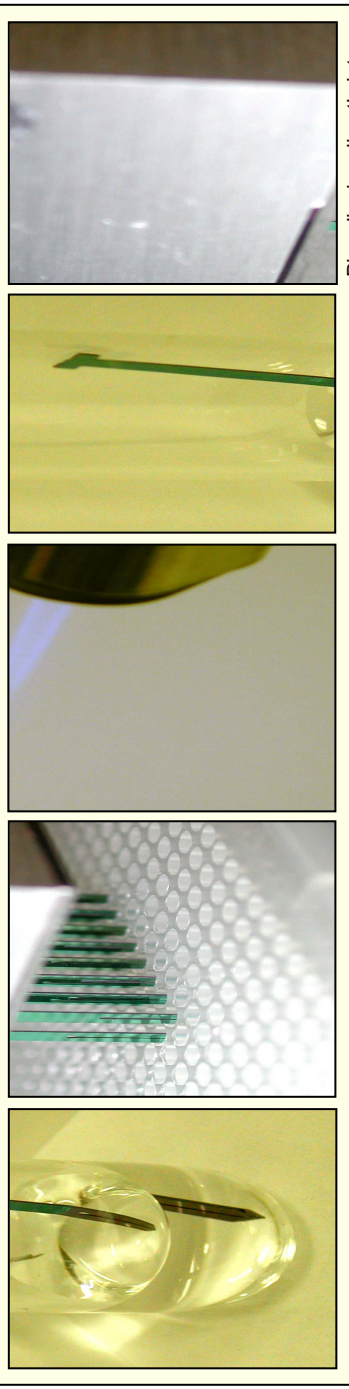


Photomicrographs of A) a Si pin with tip size 100X100µm and B, C) various pin tip shapes



SEM picture of a silicon pin tip, with a pin tip area of 200 x 200µm.

Don't try the following experiments with your metal pins!



Pins dipping directly into a 1536 source plate.

The tip shows no visible wear after 50,000 print cycles on aluminum oxide sandpaper.

A silicon pin glowing red hot in the flame of a butane torch.

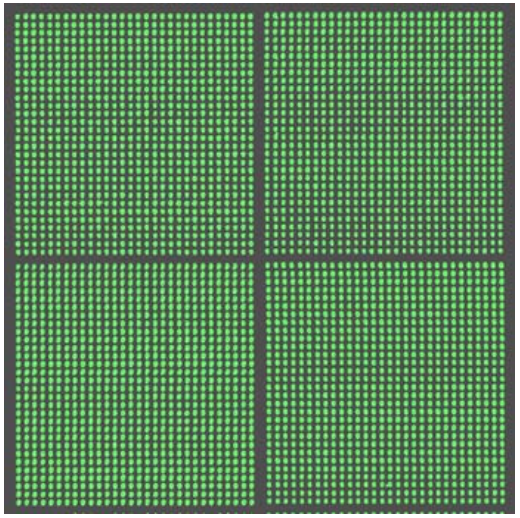
Si pins are unaffected by treating with concentrated nitric acid or H_2O_2/H_2SO_4 at room temperature.

Reversibly stretching the prongs of the pin from 25µm to 200µm with a razor blade.

Comparison of the features, advantages and benefits between silicon and stainless steel microspotting pins

FEATURE / BENEFIT	SILICON MICROARRAY™	STAINLESS STEEL
Deposited drop size and uniformity	Since tip has smaller, more precise features, smaller more uniform spots result	Larger, more irregular spots
Pin-to-pin uniformity as manufactured	Pins are identical	Much more variability
Cost	<25% the cost of the current finest printing technologies	Expensive
Prespotting phenomenon	Essentially no prespotting	Prespotting is observed
Complete depletion of printing fluid	The pins print to dryness utilizing all sample imbibed	Most fluid taken up remains in the pin
Highly precise volumetric uptake	Smaller (25 250 nL per dip) volumetric uptake, reduced oligo waste	Larger (~ 1-2 µL)
Surface friction sliding against other materials	Lower, leading to reduced wear and improved repeatability	Higher, requires hand polishing
Chemical resistance	Excellent	Good
Methods known to chemically modify surface	Extensive surface chemistry of SiO_2 known	Less well developed
Pin tip sizes available	Tip sizes ranging from 50x50µm to 200x200µm	Tip sizes ranging from 75 to 360µm in diameter
Hardness of tip material	Much harder, no tip deterioration such as bending, blunting or mushrooming	Softer, less resistance to tip bending
Can be used in cold room	Silicon-on-silicon does not seize	Brass holder grabs steel pins in cold room
Machining tolerances/feature	In micrometers (µm), 25µm =0.001	In thousandths of an inch
Ease of complex feature fabrication	All features (large or small) made at once	Each feature individually machined
Weight of pins	Si pins weigh ~ 0.5% of steel pins; less tip wear	Heavy pins damage tips
Packing density of pins into holder	Very High; 96, 384 or 1536 source plates can be directly used, <1mm pin spacing possible	Packing density of steel pins limited to 4.5mm

Microarrays of Cy3 labeled 9-mers in 3x SSC printed using silicon pins spaced on 4.5mm centers with a spot spacing of 170 µm (above). The above image shows all the spots (including prespotting) printed from a single uptake volume of 100nL. Arrays printed with a spot spacing of 145µm (below).



Specifications of the silicon pins

For arrays printed with individual pins in test print mode

	Tip Size 100 x 100µm	Tip Size 75 x 75µm	Tip Size 50 x 50µm
Average spot diameter	130 µm	100 µm	80 µm
% CV (for the first 400 spots)	7%	4%	4%
Total number of spots per dip	350 - 500	400 - 600	500-700
Volumetric uptake per dip	~100nL	~100nL	~100nL

*Greater discounts on large volumes available

OEM enquiries welcome

For more information and purchasing please contact us at (408) 749-8318 or info@parallel-synthesis.com

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