Pramod Kolar

Duke University
130 Hudson Hall
Durham, NC 27706
USA

Richard B. Fair

pkolar@duke.edu

Non-Contact Electrostatic Stamping for DNA Microarray Synthesis (20)

We present a novel non-contact printing method for DNA microarray synthesis that has no moving parts and is entirely voltage controlled.The system consists of two parallel glass plates with a platinum wire in between. The bottom plate has an electrode track used for droplet positioning and transport. The droplet (500 nl containing DNA or 0.1mM KCl with fluoroscene) is fired up along the z-axis using a DC voltage step. The step can be as low as 50V but 200V steps give consistent results. The spot area is in the range of 0.45 mm2. We observed that the spot is sensitive to the step itself and the magnitude of applied voltage only determines the time it takes for actual spot formation. Lower voltages generally result in more circular spots. If we apply a gradual ramp, then the z axis actuation is not observed until a much higher voltage is reached. Reducing droplet volume reduces spot area. The smallest volume we spotted was 300 nl. Changing the oil viscosity also affects the drop motion and hence the footprint. When the array plates are hydrophobized with small hydrophilic wells in them, the footprints are very precise.

This system can produce spots repeatedly in a consistent manner. It is also very economical to build and the whole system is no bigger than the array slide itself. There is no problem of dust contamination as the whole system is immersed in silicone oil. The system is self-aligned as the spot position is always directly above the track electrode.