

Mass assembly technology for large arrays of capillaries

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Manual assembly of capillary arrays comprising hundreds of capillaries for electrophoresis instrumentation is laborious and costly, and becomes impractical for ultra-high throughput arrays of thousands of capillaries. A semi-automated capillary array assembling machine has been created to facilitate this task, reducing assembly time by two-thirds as compared to manual assembly. In this device, a linear stage is automatically indexed to successive positions in a two-dimensional array. At each position, a cartridge containing 10-30 capillaries is repeatably attached to the stage using kinematic couplings. The key feature of this design is the steel cartridge that contains a row of evenly spaced trapezoidal troughs accurately fabricated by microelectrode discharge machining (microEDM) to $<5\ \mu\text{m}$ process variation. Each trough non-destructively pinches a capillary upon application of a preload force, thus constraining it for insertion into the array. The cartridge is easily filled with capillaries by rolling a bundle of them across the troughs. This array assembly technology eliminates time-consuming handling and meets assembly alignment tolerances, enabling array manufacture with dramatically reduced time and cost.

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