range of microchip-based electrospray devices. Thus, fluids may be introduced to the multiple electrospray device at higher flow rates as the total fluid flow is split between all of the nozzles. For example, by using 10 nozzles per fluid channel, the total flow can be 10 times higher than when using only one nozzle per fluid channel. Likewise, by using 100 nozzles per fluid channel, the total flow can be 100 times higher than when using only one nozzle per fluid channel. The fabrication methods used to form these electrospray nozzles allow for multiple nozzles to be easily combined with a single fluid stream channel greatly extending the useful fluid flow rate range and increasing the mass spectral sensitivity for microfluidic devices.

[0060] The use of polymer monoliths contained within the through-substrate channels of this electrospray device incorporating multiple nozzels is a significant advance compared to prior disclosed microchip-based separations-electrospray systems and methods combined with mass spectrometry. Polymer monoliths have demonstrated that faster separations are possible while maintaining chromatographic resolution simply by increasing the linear flow velocity of the mobile phase. The use of multiple electrospray nozzles for one separation channel will be able to accommodate the higher flow rates necessary for fast, rapid microchip-based separations using polymer monolithic beds. The use of through-substrate channels allows for simultaneous deposition of discreet sample volumes on the polymer monoliths on the injection side of the substrate. The analytes contained within the sample volumes will partition into the polymer monolith while the fluid droplets evaporate. A fluidic probe or array of probes can then interface to the injection side of the microchip to deliver a mobile phase to the device to cause the separation and electrospray mass spectrometry analysis of the transferred analytes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0061] **FIG. 1A** shows a perspective view of the ejection or nozzle side polymer monolith/multiple-nozzle electrospray device of the present invention.

[0062] **FIG. 1B** shows a perspective view of the injection or polymer monolith side of a polymer monolith/multiple-nozzle electrospray device of the present invention.

[0063] **FIG. 1C** shows a perspective view of the injection or polymer monolith side of a polymer monolith/multiple-nozzle electrospray device of the present invention showing reservoir extension block **276**. The reservoir extension block can function as a larger fluid reservoir or contain polymer monolith to increase the separation column length.

[0064] **FIG. 1D** shows a plan view of a one-nozzle electrospray device of the present invention.

[0065] **FIG. 1E** shows a plan view of a two-nozzle electrospray device of the present invention.

[0066] **FIG. 1F** shows a plan view of a three-nozzle electrospray device of the present invention.

[0067] **FIG. 1G** shows a plan view of a fourteen-nozzle electrospray device of the present invention.

[0068] **FIG. 1H** shows a perspective view of a one-nozzle electrospray device of the present invention.

[0069] **FIG. 1I** shows a perspective view of a two-nozzle electrospray device of the present invention.

[0070] **FIG. 1J** shows a perspective view of a three-nozzle electrospray device of the present invention.

[0071] **FIG. 1K** shows a perspective view of a fourteen-nozzle electrospray device of the present invention.

[0072] **FIG. 1L** shows a cross-sectional view of a one-nozzle electrospray device of the present invention.

[0073] **FIG. 1M** shows a cross-sectional view of a two-nozzle electrospray device of the present invention.

[0074] **FIG. 1N** shows a cross-sectional view of a three-nozzle electrospray device of the present invention.

[0075] **FIG. 1O** shows a cross-sectional view of a fourteen-nozzle electrospray device of the present invention.

[0076] FIGS. **2A-2E** show a cross-sectional view of a polymer monolith/multiple-nozzle electrospray device of the present invention illustrating the transfer of a discreet sample volume to polymer monolith on the injection side. The analytes A and B partition to the polymer monolith, the sample volume evaporates, mobile phase is delivered to the microchip via a fluid delivery device and reconstitution and liquid separation-electrospray mass spectrometry analysis of the analytes A and B is performed.

[0077] FIGS. **3A-3D** show a cross-sectional view of a polymer monolith/multiple-nozzle electrospray-device of the present invention illustrating the loading of a large sample volume to the reservoir. The polymer monolith is contained within the injection side of the present invention. Analytes A and B are adsorbed to the polymer monolith, the sample volume evaporates, a mobile phase is delivered to the microchip via a fluid delivery device and reconstitution and liquid separation-electrospray mass spectrometry analysis of the analytes A and B is performed.

[0078] FIGS. **4A-4E** show a cross-sectional view of a polymer monolith/multiple-nozzle electrospray device of the present invention bonded to a reservoir substrate. These Figures illustrate the loading of a large sample volume to a reservoir bonded to the injection side of the present invention, partition of the analytes A and B to the polymer monolith, evaporation of the sample volume, delivery of a mobile phase to the microchip via a fluid delivery device and reconstitution and liquid separation-electrospray mass spectrometry analysis of the analytes A and B.

[0079] FIGS. **5A-5D** show a cross-sectional view of a polymer monolith/multiple-nozzle electrospray device of the present invention bonded to a reservoir substrate wherein the polymer monolith is contained within the reservoir and the microchip. These Figures illustrate the loading of a large sample volume the polymer monolith, evaporation of the sample volume, delivery of a mobile phase to the microchip via a fluid delivery device and reconstitution and liquid separation-electrospray mass spectrometry analysis of the analytes A and B.

[0080] **FIG. 6A** shows a cross-sectional view of a two-nozzle electrospray device of the present invention generating one electrospray plume from each nozzle.

[0081] **FIG. 6B** shows a cross-sectional view of a two-nozzle electrospray device of the present invention generating two electrospray plumes from each nozzle.