



(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2002/0000517 A1**

**Corso et al.**

(43) **Pub. Date: Jan. 3, 2002**

(54) **SEPARATION MEDIA, MULTIPLE ELECTROSPRAY NOZZLE SYSTEM AND METHOD**

(76) Inventors: **Thomas N. Corso**, Lansing, NY (US);  
**Gary A. Schultz**, Ithaca, NY (US);  
**Simon J. Prosser**, Ithaca, NY (US);  
**Xian Huang**, Ithaca, NY (US)

Correspondence Address:  
**Michael L. Goldman**  
**NIXON PEABODY LLP**  
**Clinton Square**  
**P.O. Box 31051**  
**Rochester, NY 14603 (US)**

(21) Appl. No.: **09/764,698**

(22) Filed: **Jan. 18, 2001**

**Related U.S. Application Data**

(63) Non-provisional of provisional application No. 60/176,605, filed on Jan. 18, 2000.

**Publication Classification**

(51) **Int. Cl.<sup>7</sup> ..... H01J 49/00; B01D 59/44**

(52) **U.S. Cl. .... 250/288**

(57) **ABSTRACT**

A microfabricated silicon chip with a separation material, such as in situ prepared porous polymer monoliths in its microchannels is disclosed. The polymer monoliths are liquid-permeable and serve as microcolumns for liquid chromatography, which are prepared by in situ radical polymerization of a mixture containing vinyl monomers and solvents (porogen) in the microchannels. A method and system are disclosed to generate one or more electrospray plumes from one or more nozzles that provide an ion intensity as measured by a mass spectrometer that is approximately proportional to the number of electrospray plumes formed for analyses contained within the fluid. A plurality of electrospray devices can be used in the form of an array of miniaturized separate electrospray devices for the purpose of generating multiple electrospray plumes from multiple nozzles for the same fluid for analysis. This invention dramatically increases the sensitivity of microchip electrospray devices compared to prior disclosed systems and methods. The silicon chip having the packed microchannels disclosed herein finds application in coupling with mass spectrometry for sample analysis. Also disclosed is a separation block having multiple through-substrate channels filled with a separation material such as polymer monolith which can be stacked in multiple blocks for sequential two-dimensional chromatographic separation and integrated with the electrospray device.