Fabricated Chemical Separation Devices: Micro to Nano

J. Michael Ramsey
Chemical Sciences Division
Oak Ridge National Laboratory
Oak Ridge, TN 37831-6142

Tremendous interest in microfabricated fluidic channel structures (microchips) has grown over the past decade due to the large number of powerful demonstrations that have appeared in the literature. The diversity of chemical and biochemical measurement techniques implemented on microchips is large including various electrophoretic and chromatographic separations, chemical and enzymatic reactions, noncovalent recognition interactions, sample concentration enhancement, and cellular manipulations. In addition the types of samples addressed by microchips has been broad in scope, e.g., small ions and molecules, single and double stranded DNA, amino acids, peptides, and proteins. These devices have low cost devices and small footprints while consuming miniscule quantities of reagents and producing rapid results. Moreover, the manufacturing strategy used to make these devices, i.e., photolithography, allows highly parallel systems to be fabricated at low incremental cost. All of these features suggest the possibility to perform chemical experimentation at a massive scale at low cost on a bench top. More recently we have been investigating the prospects of shrinking the channel dimensions by a factor of ≈ 1000, i.e., to molecular length scales. Fundamental studies of electrokinetic fluid transport have been investigated in addition to some promising applications. Some of our latest results in these areas of research will be presented.

Research sponsored by the National Center for Research Resources, National Institutes of Health, under Grant number R01-RR14551-02. Oak Ridge National Laboratory is managed and operated by UT-Battelle, LLC, under contract DE-AC05-00OR22725 with the U.S. Department of Energy.