Progress Toward a High-Throughput Nanoextractor

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A critical barrier to the routine use of nanomaterials is the tedious, expensive means of their synthesis. It is expected that the field of nanoproduction can be advanced using the improved process control made available within highly parallel, process-intensified microsystems. Microsystems technology has the capacity to transform current batch nanoproduction practices into continuous processes with rapid, uniform mixing and precise temperature control. Advantages of microsystems technology include eliminating air contact, thereby minimizing contamination and improving yield; minimizing the environmental impact of nanoproduction including solvent free mixing; integrated separation techniques and reagent recycling; and the possibility of synthesizing nanomaterials in the required volumes at the point of use eliminating the need to store and transport potentially hazardous materials. A key requirement of this microsystems technology is the need for high-throughput extraction technology to minimize excess reagent and defective product to further improve yields in downstream reactions. In this paper progress is reported for developing high-throughput nanoextraction technology for implementation in microsystems. In particular, we explore methods for surface immobilization of monolithic sorbents in microfabricated fluidic pathways and the subsequent use of these sorbents in a novel nanoextraction technique. Implementation of the nanoextractor is within a stiff polymer sheet architecture with the capability to integrate pneumatic valves for injection and extraction. The fabrication architecture bears the added advantage of providing an economical pathway to “numbering up” for high-throughput production.