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New Materials Based Lab-on-a-Chip Microreactors: New Device for Chemical Process

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There is a growing interest in innovative chemical synthesis in microreactors owing to high efficiency, selectivity, and yield. In microfluidic systems, the low-volume spatial and temporal control of reactants and products offers a novel method for chemical manipulation and product generation. Glass, silicon, poly(dimethylsiloxane) (PDMS), and plastics have been used for the fabrication of miniaturized devices. However, these materials are not the best due to either of low chemical durability or expensive fabrication costs.

In our group, we have recently addressed the demand for economical resistant materials that can be used for easy fabrication of microfluidic systems with reliable durability. We have suggested the use of various specialty polymers such as silicon-based inorganic polymers and fluoropolymer, flexible polyimide (PI) films that have not been used for microfluidic devices, although they have been used for other areas. And inexpensive lithography techniques were used to fabricate Lab-on-a-Chip type of microreactors with differently devised microchannel design. These microreactors were demonstrated for various synthetic reactions: liquid, liquid-gas organic chemical reactions in heterogeneous catalytic processes, syntheses of polymer and non-trivial inorganic materials. The microreactors were inert, and withstand even harsh conditions, including hydrothermal reaction. In addition, various built-in microstructures inside the microchannels, for example Pd decorated peptide nanowires, definitely enhance the uniqueness and performance of microreactors. These user-friendly Lab-on-a-Chip devices are useful alternatives for chemist and chemical engineer to conventional chemical tools such as glass.

Keywords: New Material, Lab-on-a-Chip. Microreactor