CHAPTER ELEVEN

Microfluidic devices

Microfluidics refers to the behavior, precise control, and manipulation of fluids that are geometrically constrained to a small scale. Microfluidics devices have great potential to synthesize nanoparticles and nanocomposites, due to the efficient heat and mass transfers and spatial limitations in microfluidic devices, and it have great potential to synthesize nanoparticles and nanocomposites, due to the efficient heat and mass transfers and spatial limitations in microfluidic devices, convenient parameter adjustments, and in situ process monitoring in microreactors. Microfluidics refers to the behavior, precise control, and manipulation of fluids that are geometrically constrained to a small scale (typically sub-millimeter) at which surface forces dominate volume tric forces. It is a multidisciplinary field that involves engineering, physics, chemistry, biochemistry, nanotechnology, and biotechnology. Typically microfluidic systems transport, mix, separate, or otherwise process fluids. Various applications rely on passive fluid control using capillary forces, in the form of capillary flow modifying elements, akin to flow resistors and flow accelerators. In some applications, external actuation means are additionally used for a directed transport of the media. Examples are rotary drives applying centrifugal forces for the fluid transport on the passive chips. Active microfluidics refers to the defined manipulation of the working fluid by active (micro) components such as micropumps or microvalves. Micropumps supply fluids in a continuous manner or are used for dosing. Microvalves determine the flow direction or the mode of movement of pumped liquids. Often, processes normally carried out in a lab are miniaturised on a single chip, which enhances efficiency and mobility, and reduces sample and reagent volumes. he past few decades has witnessed an intensive drive in the development of microfluidic technologies and devices that have tremendous applications in diverse sectors from defence to healthcare. Entire analytical protocols, including sample pretreatment, sample/reagent manipulation, separation, reaction, and detection can be performed significantly quicker on these miniaturised and compact devices