Special Issue on Microfluidics and Related Nano/Microengineering for Medical and Chemical Applications

Preface

Current technological developments for the production of structures on microscopic and sub-microscopic scales have led to a wide range of scientific research and technological advances that enable fluid samples to be rapidly and accurately controlled for these kinetic behaviors in desired flow conditions. This has led to the development of very compact devices and systems capable of performing a wide range of unit chemical operations on fluids and particulates with precision and efficiency. Transport phenomena and fluid dynamics in channels on the scale of micrometers to nanometers are becoming increasingly important in several new fluid applications. This is because of the high transport efficiency of molecules in fluids resulting from the larger surface-to-volume ratio due to miniaturization, the possibility of continuous and more complex combinations and multiplex steps of unit chemical operations, the integration of functions and the miniaturization of systems for specific diagnostic and testing applications, as well as the development of biological structures at multiple scales from nucleic acid to cellular level. This is supported by inherent advantages of microfluidics such as the possibility of continuous and more complex combinations and parallelism, and the variety of manipulations on biological structures at multiple scales from nucleic acid to cellular level.

The field of microfluidics is now regarded as one of the key sciences and technologies of miniaturization for cutting-edge microsystems. It has been widely developed in various industrial fields, demonstrating novel abilities for practical applications in medicine, biology, chemistry, and engineering fields. The transition toward total analysis diagnostic microfluidic systems not only requires more multiplex functions for precise fluid handling based on each property of structural materials, but also opens up the way for fully automated point-of-care systems. It is essential to introduce advanced device and material technologies in these key devices. This special issue will focus on the state-of-the-art technologies using microchannels and related elements for unit chemical operations, related microfabrication, optical sensing devices, and electrochemical devices.

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