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Specific structural features of microfluidic devices and their application

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Abstract

It is commonly known that the major advances in science in recent decades are associated with reducing the size of various laboratory and diagnostic equipment and improving their technological characteristics. The tendency is centred around the use of microfluidic devices that are currently an important tool for the modern scientific community. In other words, microfluidic and micro-capillary systems are a new and actively developing area of contemporary science. Microfluidics can be characterised as an applied science that is integrated in multiple fields: from integrated circuits and applied crystallography (protein crystallization) to biological and medical research. The technology has come a long way from the first miniature gas chromatograph in the 1970s to the present day organ and tissue chip models. Due to the synthetic study of microfluidic systems, these devices can act as cooling systems on high-performance chips with the coolant pumped through microchannels; as systems of microchannels of various shapes and sizes for experimental research; as microreactors for enhanced reagent mixing; as biochips for express testing with an opportunity of simultaneous detection of several substances using a single device and only 1 μl of the test material, etc. The profound interest in this area is largely due to the number of advantages that microfluidics has over other technologies, such as, for example, considerable reduction in the reagent consumption and the possibility to accurately monitor heat and mass transfer. However, it should also be noted that despite the obvious advantages of the technology, microfluidic systems still have a number of disadvantages. The purpose of this review is to summarize and consolidate the current data on materials, devices, application peculiarities of microfluidic systems in various research fields and the resulting prospects for their further development and application.

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