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Single Microparticle Separation by Thermal Bubble Actuation in Microfluidic Chips

Kehsin Tseng and Chingfu Tsou*

Department of Automatic Control Engineering, Feng Chia University,
100 Wenhwa Road, Seatwen, Taichung 40724, Taiwan, R.O.C.

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Cell and microparticle separation in microfluidic systems, which is typically achieved by applying forces to the targets to guide them along different paths, has recently gained significant attention for the preparation of samples in biological and chemical studies. Therefore, we propose a new microfluidic chip with a resistive silicon-based microheater, where noncontact force is applied by thermal bubble actuation for microparticle separation. The static and dynamic electrothermal coupling characteristics of the resistive microheater and the flow behaviors of fluid in the microchannel were evaluated by finite-element analysis and using the commercial simmulation software COMSOL, respectively, to provide an applicable design. The feasibility of a thermal bubble-pumping fluid to manipulate a microbead of 20 μm diameter has also been verified by experiments. It is expected that the proposed microfluidic chip can be applied to the separation of cells, such as live cells in amniotic fluid.

*Corresponding author: e-mail: cftsou@fcu.deu.tw