Design and Fabrication of Piezoelectric Valveless Micropump

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ABSTRACT

The main function of micropump system is to control minute flow rate exactly. In this study, valveless type of piezoelectric micropumps which used diffuse/nozzle structure to replace the conventional cantilever beam type of valve are chosen .The valveless micropump was constructed of one nickel electroforming vibration plate, PDMS or nickel electroforming channel plate, two glass tubes, a PZT actuator and a glass substrate. The optimum dimension of actuating module is obtained for the fabrication by ANSYS numerical simulation. A micropump system in the way could reduce the cost of production , increase the ratio of success and could be mass production. The effects of driving voltage and frequency on the displacement of piezoelectric material and the flow rate of the micropump are investigated .The maximum attainable flowrate is 0.93 ml/min when it is driven by a sin wave of Vpp=80volt, 530Hz. The maximum attainable backpressure is 2.55Kpa

Keywords : Piezoelectricity, PDMS, Micro Electroforming, ANSYS

Table of Contents

REFERENCES

[1]Y. Xian, G. M. White sides, “ Soft Lithography ”, anew. Chem. Int. Ed., Vol. 37, pp. 550-575, 1998.

[2]Y. Xian, G. M. White sides, “ Soft Lithography ”, anew. Mate, Vol. 28, pp. 153-184, 1998.

[3]C. Cabot, W. R. Herb, E. I. Cabot, S. T. Lu, “ The Dual Diaphragm Pump ”, 14th IEEE Int. Conf. on Micro Electro Mechanical Systems, pp. 519-522, 2001.

[4]M. Koch, A. G. R. Evans, A. Bruins chewier, “ The Micro pump Driven With a Screen Printed PZT Actuator ”, J. Micro mech. Micro eng. , Vol.8, pp.119-122, 1998.

[5]E. Ming, X. Q. Wang, H. Mark, Y. C. Tai, “ A Check-Valve Silicon Diaphragm Pump ”, 13th IEEE Int. Conf. on Micro Electro Mechanical Systems, pp. 23-27, 2000.

[6]O. C. Jung, S. S. Yang, “ Fabrication and Test of mope ’ s mantic Micro pump with A Corrugated p+ Diaphragm ”, Sensors and Actuators A, Vol. 83, pp. 249-255, 2000.

[7]M. Fiji, M. Takashi, S. Takayuki, “ Fabrication of Ti Ni Memory Micro pump ”, Sensors and Actuators A, Vol. 88, pp.256-262.

[8]N. T. Nguyen, et al., “ Integrated Flow Sensor for In-Situ91 Measurement and Control of Acoustic Streaming in Flexural Plate Wave Micro Pumps ”,Sensors and Actuators A , Vol. 79, pp.115-121, 2000.

[9]S. H. Ann, Y. K. Kim, “ Fabrication and Experiment of A Planar Micro Ion Drag Pump ”,Sensors and Actuators A , Vol. 70, pp. 1-5,1998.

[10]J. Jang, S. S. Lee, “ Theoretical and Experimental Study of MHD Micro pump ”, Sensors and Actuators A , Vol. 80, pp. 84-89, 2000.

[11]S. Boehm, W. Olthuis, P. Bergveld, “ A Bi-Electrochemically Driven Micro Liquid Dosing System with Integrated Sensor/Actuator Electrodes ”, 13th IEEE Int. Conf. on Micro Electro Mechanical Systems, pp. 92-95, 2000.

[12]Shoji S.Nakagawa S.and Esashi M., 1990, Micro pump and sample-injector forintegrated chemical analyzing systems Sensors Actuators, A21-23, 189-192.

[13]Olssen A., Enoksson P., Stemme G., Stemme E., 1996, A valve-less planar pumpisotropically etched in silicon, J. Micromech, 6, 87-91 [14]M.

Koop, C. Lin, “ A Novel Micro machined Micro fluid Pump ”, Proceedings of the 22nd Annual EMBSInternational Conference, July 23-23, pp. 2394-2397, 2000.
[15]李俊賢, “ 可攜式無閥壓電微幫浦之設計製作與應用 ”, 國立臺灣大學應用力學研究所91碩士論文.