壓電式微致動閥之設計與製作

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摘 要

本文提出設計、實驗及製作出主動式微閥門應用在微幫浦。致動器是選用壓電材料，當驅動壓電致動器產生單軸向位移後可使微閥門達到開啟或關閉的動作。本微閥門結構設計上有兩種樣式，正常狀態下微閥門關閉或開啟。工作流體採用去離子水(De Ion Water)，透過壓電式微幫浦輸出流率11.29~22.23 ml/min及6~12 kPa的水壓，當搭配正常狀態下微閥門關閉的結構，給予致動器電壓從0 V到100 V，流率為0.02~2.13 ml/min，每分鐘最大流量誤差為1.4~10%；當搭配正常狀態下微閥門開啟的結構，流率為0.01~3.19 ml/min，每分鐘最大流量差誤為0.9~10%。

關鍵詞 : 主動式微閥門、壓電致動器、流率、微流量

目錄

參考文獻

[1]I. Chakraborty, W.C Tang, D.P. Bame and T.K Tang,“ MEMS micro-valve for space applications, ” Sensors and Actuators 83 (2000) 188 – 193.

[2]T. Rogge, Z. Rummler and W.K. Schomburg,“ Polymer micro valve with a hydraulic piezo-drive fabricated by the AMANDA process, ” Sensors and Actuators A 110 (2004) 206 – 212.

[3]A. Doll, M. Wischke, H.-J.Schrag, A. Geipel, F. Goldschmidtboeing and P. Woias,“ Characterization of active silicon microvalves with piezoelectric membrane actuators, ” Microelectronic Engineering 84 (2007) 1202 – 1206.

[4]I Fazal and M C Elwenspoek,“ Design and analysis of a high pressure piezoelectric actuated microvalve, ” J. Micromech. Microeng. 17 (2007) 2366 – 2379.

[5]M. Sobocinski, J. Juuti, H. Jantunen and L. Golonka, “ Piezoelectric unimorph valve assembled on an LTCC substrate, ” Sensors and Actuators: A Physical (2008), doi:10.1016/j.sna.2008.11.025.
[6]Levent Yobas, Michael A. Huff, Frederick J. Lisy, and Dominique M. Durand, “ A novel bulk-micromachined electrostatic microvalve with a curved-compliant structure applicable for a pneumatic tactile display, ” Journal of microelectromechanical systems, VOL. 10, NO. 2, JUNE 2001.
[7]H Kahny, M A Huffz and A H Heuery, “ The TiNi shape-memory alloy and its applications for MEMS, ” J. Micromech. Microeng. 8 (1998) 213 – 221.
[8]Barth, P.W., Proceedings of Transducers ’ 95, the 8th International Conference on Solid-State Sensors and Actuators and Eurosensors IX; Stockholm, Sweden, June 1995, pp. 276 – 277.
[9]Mircea Capanu, James G. Boyd, IV, and Peter J. Hesketh, “ Design, Fabrication, and Testing of a Bistable Electromagnetically Actuated Microvalve, ” Journal of microelectromechanical systems, VOL. 9, NO. 2, JUNE 2000.
[10]P.J. Hesketh, J.S. Bintoro, R. Luharuka, “ Microvalve for Fuel Cells and Miniature Gas Chromatographic System, ” School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA 30332 2004.
[11]P Nageswara Rao and Deepak Kunzru, “ Fabrication of microchannels on stainless steel by wet chemical etching, ” J. Micromech. Microeng. 17 (2007) N99 – N106.
[12]Sudipta Chatterjee, Motoki Ujihara, Dong Gun Lee, Jerry Chen, Stanley Lei and Greg P Carman, “ Spray etching 2 μ m features in 304 stainless steel, ” J. Micromech. Microeng. 16 (2006) 2585 – 2592.