研究生: 張良鋐

研究生(英文姓名): Liang-Cheng Chang

論文名稱: 微量移液器取樣體積定量感測器開發

英文論文名稱: Development of The Micropipetting Error Sensor

指導教授: 李達生

指導教授(英文姓名): Dasheng Lee

學位類別: 碩士

校院名稱: 國立臺北科技大學

系所名稱: 冷凍空調工程系所

學號: 93458009

學年度: 94

語文別: 中文

論文頁數: 65

關鍵詞: 微機械結構系統 ; 速度感測器 ; 微量移液器

英文關鍵詞: MEMS ; flow sensor ; Pipet

被引用次數: 0

[摘要]

本研究開發微機械結構系統之速度感測器應用於微量移液器偵測取樣容積定量，微結構速度感測器中心位置利用多
知器，感測速度利用微發熱器在微結構中產生熱氣泡，由移液器活塞移動驅使微熱氣泡變形，四周的溫度感知器偵
液滴管內溶液體積，其微結構速度感測器製造過程由標準金屬氧化半導體製程做材料的沉積，再利用蝕刻技術完成
形構造，其中包含了微結構系統及訊號電路，校正結果此速度感測器的特性靈敏度爲1V/m/s、速度測試範圍在0.0
高解析度、高靈敏度及具線性等特性，將微結構速度感測器應用於微量移液器可顯示出取樣體積，實驗驗證在20μ
者使用在正當模式下操作，從DNA增生實驗結果中可以看出利用此微量移液器所進行之實驗可以更穩定的增生DN

[英文摘要]

The study developed an integrated MEMS flow sensor applied in detecting the volume of samples in Pipet. The r
micro heater and a thermopiles array. The centered micro heater bar encircled by temperature sensors generate
flow, the thermal plume will be pushed towards to the temperature sensors array and the temperature difference
volume flow rate through the tip. This sensor includes micro structures and mixed signal processor in 2 mm squa
process. A square heater source is located at the center of square polysilicon thin film with a cavity underneath.
power is supplied to the heater. The sensitivity of the flow sensor can be indicated as 1 V/ (m/s). The air flow spe
than 5.3%. The flow sensor has a high sensitivity and linear in low speed air flow field. The experiment proves th
sample experiment of 20μL. The operator can reject improper pipetting according the readings of the pipetting er
out in this study. The results show that accurate DNA quantification and high reproducibility of experiments can b

[論文目次]

[參考文獻]

[1]N.T. Nguyen, "Micromachined flow sensors," Flow Measurement and Instrumentation, 1997, p 7-16.

[2]M. Elwenspoek and R. Wiegerink, "Mechanical Microsensoors," 2000, Springer.

[3]A. F. P. Van Putten and S. Middelhoek, "Integrated silicon anemometer," Electronic Letters, 1974, 10, pp. 425

[4]G. Stemme, "A monolithic gas flow sensors with polyimide as thermal insulator," IEEE Trans. Electron Device

[5]D. Moser, R. Lenggenhager and H. Baltes, "Silicon gas flow sensor using industrial CMOS and bipolar IC tecl 595.

[6]D. Moser and H. Baltes, "A high sensitivity CMOS gas flow sensor on a thin dielectric membrane," Sensors ai

[7]T. Neda, K. Nakamura and T. Takumi, "A polysilicon flow sensor for gas flow meters," Sensors and Actuators

[8]G. Kaltsas and A. Nassiopoulou, "Frontside bulk silicon micromachining using porous-silicon technology," Sei

[9]G. Kaltsas and A. G. Nassiopoulou, "Novel C-MOS compatible monolithic silicon gas flow sensor with porous 1999, 76, pp. 133-138.

[10]D. N. Pagonis, A. G. Nassiopoulou and G. Kaltsas, "Porous silicon membranes over cavity for efficient local Electrochemical Society, 2004, 151, pp. H174-H179.

[11]P. Y. Y. Kan and T. G. Finstad, "Oxidation of macroporous silicon for thick thermal insulation," Material Scier

[12]鄧雅薇，高解析度之新型CMOS流速感測器之開發與研究，碩士論文，國立臺灣大學機械工程研究所，台北，

[13]R. H. Curtis, G. Rodrigues, "Pipet performance verification: An important part of method validation," America

[14]R. Pavlis, "Surprising statistics on pipet performance," American Laboratory, 2004, p 8-10.
[15]J.G. Smits, "Piezoelectric micropump with three valves working peristaltically, " Sensors and Actuators A, 21
[16]H.T.G. Lintel, F.C.M. van de Pol, S. Bouwstra, "A piezoelectric micropump based on micromachining of silic
[17]E. Bassous, H.H. Taub, L. Kuhn, Ink jet printing nozzle arrays etched in silicon, Appl. Phys. Lett. 31, 1977, p
[18]K.H. Lochner, T.Ballweg, Fahrenkrog H-H. "Factors influencing the measuring accuracy of piston pipettes w
[19]江孟聲，微量吸管設計與人因工程之評估，碩士論文，國立台灣工業技術學院，台北，1996。
[20]N. Szita, R. Sutter, J. Dual, R. A. Buser, "A micropipettor with integrated sensors." Sensors and actuators A,
[21]T.S.J. Lammerink, M. Elwenspoek, J.H.J. Fluitman, Integrated micro-liquid dosing system, Proc. MEMS93, F