The electroforming microfabrication of piezoelectric ejector components

陳宗聖、鄭江河

E-mail: 9314551@mail.dyu.edu.tw

ABSTRACT

The printer is the necessities of every family. And the inkjet printer is the mainstream of the printer at present. The inkjet print-head is the soul in the inkjet printer. Among various actuating ways, the extensively used is piezoelectric actuator. With the development of High-Tech industry, the application of inkjet printing become more extensive, such as biotechnology, optical communication component, micro-electro-mechanical system, industry of the engine, and organic LED display, etc. The study aims at the microfabrication of the vibration plate and nozzle plate used in piezoelectric-actuated microjet head by UV-LIGA technology. We propose a novel electroplating method, named double-side electroplating, to obtain the nickel plate with multilevel microstructure on both sides. Besides, the spill electroplating technology, electroplating over the photoresist mold, is utilize to obtain the nozzle and embedded flow channel.

Keywords : Piezoelectric, Micro-Jet, Electrofoming, LIGA-like

Table of Contents

REFERENCES

[1] 楊實文, “ 壓電噴墨頭-微陣列致動器之設計與製作 ”, 私 立大葉大學機械工程研究所碩士論文, 2003 [2] 葉吉田, “ 噴墨列印技術在電子工業之應用 ”, 電子與材料, 第二期, 52-55, 1999 [3] 張棋榕, “ 以噴墨方法製作彩色濾光片的利基與挑戰 ”, 化 工資訊月刊, 2001 [4] 呂

志平.周柏甫.胡紀平,“ 應用熱氣泡式噴墨法開發PLED 全彩顯示器之製程技術 ”, 工業材料雜誌, 第194 期,140-146, 1993 [5] 肯特,“ 噴墨式和熱列印式印表機技術概況 ”, 新電子, 第191 期, 2002 [6] 楊啟榮.強玲英.黃奇聲,“ 微系統LIGA 製程之精密電鑄技 術 ”, 科儀新知, 第22 卷, 第4 期, 2001 [7] 吳祥銘,“ 鎳鈷合金微電鑄技術於微模具成形之研究 ”, 國 立中興大學精密工程研究所碩士論文, 2003 [8] 許倍誠,“ 電鍍鎳組織與機械性質之研究 ”, 私立大葉大學 機械工程研究所碩士學位論文, 2000 [9] G. A. Di Bari,“ Nickel Plating ”, ASM Materials Handbook, -Vol.5, 201-212, 1994 [10] H. Brown and B. B. Knapf,“ in: Modern Electroplating 3rd ”, -Electrochemical Society, 1974 [11] 彭裕民譯, ”鍍鎳的基本溶液及工業電鍍的應用 ”, 第64卷, 54-64 [12] Lowenheim, Fredeeerick Adolph,“ Electroplating ”, American -Electroplaters ’ Society, McGraw-Hill, 1978 [13] Don Baudrand,“ Nickel Sulfamate Plating, Its Mystique and -Practicality ”, Metal Finishing, Vol.94, No.7, 15-18, 1996 [14] J. W. Dini and H. R. Johnson,“ The Influence of Nickel -Sulfamate Operating Parameters on The Impurity Content and -Properties of Electrodeposits ”, Thin Solid Films, Vol.54,183-188, 1978 [15] 曾華梁.吳仲達.陳鈞武.呂佩仁.秦月文,“ 電鍍工藝手冊 ”, 機械工業出版社, 1997 [16] 蘇癸陽譯,“ 實用電鍍理論與實際 ”, 復文書局, 1990 [17] 鄭江河.胡榮章.葉東昇.林烜鵬,“ 壓電式噴墨頭及其製造方 法 ”, 中華民國專利公報, 568837, 2004 [18] 李鴻年.張紹恭.張炳乾.宋子玉,“ 實用電鍍工藝 ”, 國防工業出版社, 1986 [19] H. Brown and B. B. Knapf, in: Modern Electroplating 3rd, -Electrochemical Society, 1974 [20] 曾元宏,“ 脈衝電流應用於微電鑄最適化之研究 ”, 國立清 華大學化學工程研究所碩士學位論文, 2001 [21] Youngcheol Joo, Kiet Dieu, Chang-Jin Kim,“ Fabrication Of -Monolithic Microchannels For IC Chip Cooling ”, Micro -Electro Mechanical Systems, Vol.29, 362-367, 1995 [22] Hsin-chih Tim Yeh, “ Fabrication and Cooling Test of -High-Aspect-Ratio Electroplated Microchannels ”, Master of -Science, The Department of Mechanical Engineering, -University of California Los Angels,1998 [23] 謝文馨,“ UV-LIGA 應用於生物晶片之製程研究 ”, 中正 大學機械系碩士論文, 2004 [24] Popov, K. I.; Maksimovic, M. D.; Simic, M. S.“ The effect of -periodic reverse current on the surface roughness of metal -deposits and the maximal deposition rate. ” Surf. Technol., -Vol.16, 209-218, 1982 [25] Popov, K. I.; Maksimovic, M. D.; Totovski, D. C. -“ Fundamental aspects of pulsating current metal -electrodeposition VI: The comparison electrode surface -roughening in pulsating current and periodic reverse current -electrodeposition of metals. ”, Surf. Technol., Vol.17, 125-129,1982 [26] Popov, K. I.; Totovski, D. C.; Maksimovic, M. D. -“ Fundamental aspects of pulsating current metal -electrodeposition VII: The comparison of current density -distributions in pulsating current and periodic reverse current -electrodeposition of metals. ”, Surf. Technol., Vol.19, 181-185,1983 [27] W. H. William,“ in: The Properties of Electrodeposited Metals -and Alloys ”, American Electroplators and Surface Finishing -Society, 2nd, 253-325, 1986 [28] S. W. Banovic, K. Barmak and A.R. Marder,“ Microstructure -Characterization and Hardness of Electrodeposited Nickel -Coatings From a Sulphamate Bath ”, Journal of Materials -Science, Vol.33, 639-645, 1998 [29] 彭坤增,“ 銅模鍍鎳層組織及性質受熱潛熱之研究 ”, 大葉 大學機械工程研究所碩士論文, 1998