Design and Characterization of a Monolithic Integrated Thermal Inkjet Printhead

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ABSTRACT

In this paper, the fabrication of silicon microfluidic channels for monolithic inkjet printing devices is described. Two planarization processes for silicon microchannel have been developed. One is through-hole etching via SiC films and then planarizes it by plasma-enhanced chemical vapor deposition (CVD). The other is to fill the microfluidic channels with silicon oxide by low-pressure CVD and subsequent by chemical-mechanical polishing. The process technology (six masks) was demonstrated by the fabrication of a monolithic silicon microchannel structure with ink slot for thermal inkjet printing. The channel width and the nozzle diameter can be controlled form 80 to 20 mm and 50 to 10 mm, respectively. This continuous study is expected to establish some pilot experience for the next generation of photo-quality page-wide printheads. The platinum thin film is used as a heater material for the present thermal inkjet printhead due to its high thermal stability. However, the platinum thin film can not easily be etched and will form the volatile by-products, resulting in fence patterns. Experimental studies of the etching of platinum have been performed with a photoresist mask in an inductively coupled plasma. High etch rates (>50 nm/min) with fence-free patterns can be achieved under an Ar/CF4/Cl2 mixture gas. Finally, a stroboscope system for allowing the view of dynamic phenomena for ink droplet shooting to the paper has been developed. The characterization and operation parameters for a thermal inkjet printhead were studied in order to further improving the present design of the monolithic integrated thermal inkjet device.

Keywords : Monolithic ; Thermal Inkjet Printhead

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REFERENCES

[1] P. Krause, E. Obermerier, and W. Wehl, ‘A Micromechined Single-Chip Inkjet Printhead’, Sensor & Actuators, A53, pp.405-409, 1996.
[2] J. —D. Lee et. al., ‘A Thermal Inkjet Printhead with a Monolithically Nozzle Plate and Self-Aligned Ink Feed Hole Inkjet Printer’, J. Micromechanical Systems, pp.229-236, 1999.
[3] L. Palm et. al., ‘Fabrication and Characterization of Silicon Micromachined Nozzles for Continuous Inkjet Printer’, IS&Ts NIP 14, pp.54-57, 1998.
[4] 莊達人,VLSI 製造技術, page 257.

[5] M. Madou, Fundamentals of Microfabrication, page 151.
[6] M. Madou, Fundamentals of Microfabrication, page 200.
[7] J. Bhardwaj, H. Ashraf, A. McQuarrie, ‘ Dry silicon etching for MEMS ’, Symposium on Microstructures and Microfabricated System at the Annual Meeting of the Electrochemical Society,Montreal, 1997.
[8] S. Vogel, U. Schaber, ‘ Novel microstructing technologies in silicon ’, Micromaching and Microfabrication Process Technology, Austin, Texas (1995) 224.
[9] K. R. Milkove, J. A. Coffin and C. Dziobkowski, Ashraf, A. McQuarrie, ‘ Effects of argon addition to a platinum dry etch process ’, J. Vac. Sci Technol. A16,pp.1483-1488, 1997.
[10] Handbook of Chemistry and Physics, 72nd ed., edited by D. R. Lide (Chemical Rubber, Boca Rotan, 1991).