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68

EFFECT OF OXYGEN ADDITION ON SIDEWALLS OF SILICON SQUARE MICRO-PIT ARRAYS USING SF6 BASED REACTIVE ION ETCHING

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ABSTRACT

In this paper, the etching profile of silicon square micro-pits array using SF6 based Reactive ion etching (RIE) is reported. This micro-pits array was created on a Si substrate with poly methyl methacrylate (PMMA) mask during the RIE process. Effects of O_2 addition and pressure decreasing were described by chemical reactions of etching and experimental results. Atomic force microscopy (AFM) was utilized to investigate etching profile of these micro-pit arrays. Etching of micro-pits with O_2 addition results a vertical sidewall with 3 nm roughness of the inter-pit spacing, while V-groove shaped in sidewall was obtained in absence of O_2. These square micro-pits have a good potential to be used in biology applications due to its dimension, especially for confinement region for biological objects e.g. DNA.

Keywords: Silicon; Micro-pit; Reactive ion etching; Sidewall; Electron beam Lithography

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REFERENCES

[1] D. Sinton, R. Gordon, AG. Brolo, Microfluidics and Nanofluidics 4 (2008) 107-116
[2] C.H. Liu, M.H. Hong, M.C. Lum, H. Flotow, F. Ghadessy, J.B. Zhang, Appl Phys A 101 (2010) 237-241.
[3] T. Baba, N. Kamizawa, M. Ikeda, Physica B 227 (1996) 415-418
[4] Y. Xu, H.B. Sun, J.Y. Ye, S. Matsuo, H. Misawa, J. Opt. Soc. Am. B 18 (2001) 1084-1091
[5] W. Hattori, H. Someya, M. Baba, H. Kawaura, Journal of Chromatography A 1051 (2004) 141-146
[6] Y. Huang, B. Agrawal, D. Sun, J.S. Kuo, J.C. Williams, Biomicrofluidics 5 (2011) 013412
[7] D. Erickson, S. Mandal, A.H.J. Yang, B. Cordovez, Microfluid Nanofluid 4 (2008) 35
[8] X.M. Yan, S. Kwon, A.M. Contreras, M.M. Koebel, J Bokor, G A Somorjai, Catal. Lett. 105 (2005) 127
[9] R.R.A Syms, D.F. Moore, Materials Today 5 (7) (2002) 26-35
[10] R.R.A. Syms, J Micromech Microeng 12 (2002) 211-218
[11] A.J. Watts, W.J.Varhue, J. Vac. Sci. Technol. A 10 (1992) 1313
[12] Y. Lii, J. Jorne, J. Electrochem. Soc. 137 (1990) 3633
[13] E. Gogolides, H.H. Sawin, J. Electrochem. Soc. 136 (1989) 1147-1154
[14] G.S. May, J. Huang, C.J. Spanos, IEEE Trans. Semicond. Manuf. 4 (1991) 83-98

[15] I. W. Rangelow, A. Fichelscher, Proc. SPIE 1392 (1990) 240
[16] C.P.D. D'Emie, K.K. Chan, J. Blum, J Vac Scl Technol B 10 (1992) 1105-1110
[17] M. Francou, J.S. Danel, L. Peccoud, Sens Actuators Phys A 46–47 (1995) 17-21
[18] D.M. Manos, D.L. Flamm, Plasma, Etching: An Introduction. Academic Press, Boston, London (1989)
[19] T. Syau, B.J. Baliga, R.W. Hamaker, J Electrochem Soc 138 (1991) 3076-3081.
[20] R. Legtenberg, H. Jansen, M. Deboer, M. Elwenspoek, J Electrochem Soc 142 (1995) 2020-2028
[21] M. Zeuner, J. Meichsner, H.U. Poll, Plasma Sources Sci. Technol. 4 (1995) 406-415