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TAGUCHI METHOD APPLIED IN OPTIMIZATION OF SHIPLEY 5740 POSITIVE RESIST DEPOSITION

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ABSTRACT

Taguchi Methods of Robust Design presents a way to optimize output process performance through organized experiments, by using orthogonal arrays for the evaluation of the process controllable parameters. In the photoresist deposition process, there are numerous controllable parameters that can affect the surface qual it y and thickness of the final photoresist layer. To maximize the thickness and minimize the bubble formation of Shipley 5740 photoresist (our optimum goal), a number of eleven control parameters were selected. For a full matrix experiment, 2048 experiments would have been necessary. instead, by utilizing the Taguchi L 12 matrix, only 12 experiments arc necessary for optimization. The following parameters were considered:

1. Volume of photoresist deposited before spin (ml)
2. Deposition of HMDS
3. Spin speed (rpm)

4.Duration Of Spin (sec)
5. Relaxation time after spin (rein)
IS. Contact prebake starting temperature (°C)
7. Contact prebake ending temperature (°C)
8. Contact prebake ramp (°C/hr)
9. Contact bake time (rein)
10. Contact ramp down end temperature (“C)
11. Contact ramp down ramp (°C/hr)

Each parameter was evaluated at two distinct levels. Based on the L 12 orthogonal array selected, 12 experiments were performed. To improve the statistical mean, each experiment was performed twice. For the 12 experimental results, quantitative values were recorded by measuring the photortesist thickness and counting the number of bubbles generated. The collected data was analyzed by performing an analysis of variance (ANOVA) computation and evaluation. Sensitivity analyses of the parameters were derived. Theoretical prediction of parameters for optimum performance was generated. Confirmation experimental trials were performed that produced significant improvement in photoresist thickness and minimized number of bubbles. The results provide the basis for the development of multilayer photoresist process from 22 to 85 micron thick.

KEY WORDS: TAGUCH [, PHOTORESIST, OPTIMIZATION, SHIPLEY 5740, MULTI LAYER

B1OGRAPHY: AlIan Hui is a senior in Aeronautics & Astronautics at the University of Washington. His micromachining experience include working in the MicroDevices Lab at Jet Propulsion Laboratory. He also studied MEMS under Professor Masayoshi Esashi at Tohoku University in Sendai, Japan.