

Experimental Micromachining of Silicon with Nd-YAG Laser

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ABSTRACT

This research centers on experimental laser-micromachining of silicon using solid state pulsed Nd:YAG laser. The laser is equipped with 3-axis controllers with resolution of 1 μm . The main objective is to find out the possibility of using this laser machining system to fabricate a micro feature on silicon. Simple straight lines were generated on silicon surface. The two process parameters – the laser traverse speed and pulse energy- were considered in the experimental design. Two forms of experiments were carried out: (1) processing with air assist gas and (2) processing without the assist gas using the same experimental design. Standard full factorial design of 3^k was used to design the experiments. Repeatability of the machine and nonlinearity were taken into account in the design by adding center points. Sequence of experiments was also randomized. Statistical analysis of experimental results could not show any significant factor. However, the surface plot did provide general information on desirable regions for the response line width, which was consistent with the published results. Micrograph study of the featured lines revealed that the laser processing without the assist gas produced preferable results.

KEYWORDS:

Experimental Design; Laser Processing; Micro Machining; Nd-YAG; Silicon

REFERENCES

1. Dalili, B. Tan , K. Venkatakrisnan: Optics & Lasers in Eng. Vol. 48 (2010), p.346–353.
2. W. Yuan, B. Ma: Journal of Mater. Process. Techno. Vol. 200 (2008), p.390–397.
3. J. -P. Desbiens, P. Masson: Sensors and Actuators A 136, Elsevier, 2007, pp.554-563.
4. R. Biswas, A.S. Kuar, S. Sarkar, S. Mitra: Optics & Laser Techno. Vol. 42 (2010), p.23–31.
5. Avanish Kr. Dubey, Vinod Yadava: Journal of Mater. Process. Techno. Vol. 195 (2008), p.15– 26.