COMPARISON OF ETCHING OPTIMIZATION PROCESS BY TAGUCHI METHOD USING MINITAB AND DESIGN EXPERT SOFTWARE

by

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APPROVAL AND DECLARATION SHEET

This project report titled Comparison of Etching Optimization Process by Taguchi Method Using Minitab and Design Expert Software was prepared and submitted by Azleen Abu Talib (031010052) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the Bachelor of Engineering (Microelectronic Engineering)in Universiti Malaysia Perlis (UniMAP).

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PERBANDINGAN PENGOPTIMUMAN PROSES PUNARAN OLEH KAEDAH TAGUCHI MENGGUNAKAN PERISIAN STATISTIK "MINITAB" DAN "DESIGN EXPERT"

ABSTRAK

Satu rekaan ujikaji untuk daya pemprosesan tinggi, pad punar menggunakan punaran ion reaktif dilaporkan. Rekabentuk ujikaji adalah satu teknik untuk mengoptimumkan process yang mempunyai input-input yang terkawal dan keluaran yang boleh diukur. L9 orthogonal array menggunakan kaedah Taguchi diaplikasikan untuk Modul *Passivation* (Punaran Pad) bagi mendapatkan kadar punaran yang sesuai dan keseragaman atas permukaan wafer. Data disimulasikan dalam dua perisian statistik iaitu "Minitab" dan "Design Expert" untuk mendapatkan gabungan optimum parameter dengan kadar punaran yang sesuai serta pengurangan kos pemprosesan. Rekaan ujikaji mengandungi empat parameter boleh ubah iaitu kuasa RF, nisbah gas CHF_3/CF_4, tekanan dan kadar aliran gas Argon. Hasil keluaran kajian yang ditentukan oleh kadar punaran, keseragaman dan Titanium Nitrida (TiN) yang tinggal adalah kriteria berjaya diambil kira. Didapati kadar punaran sangat dipengaruhi oleh kuasa RF dan nisbah gas CHF_3/CF_4 tetapi kurang dipengaruhi oleh tekanan dan kadar aliran gas Argon. Berdasarkan keputusan yang didapati daripada kedua-dua perisian statistic, didapati keduanya mencadangkan parameter yang sama iaitu kuasa RF sebanyak 1000 W, nisbah gas CHF_3/CF_4 sebanyak 30/50, kadar aliran gas Argon sebanyak 150 sccm dan tekanan sebanyak 200 mTorr. Sementara itu, perisian statistic yang direkomenkan adalah "Design Expert" memandangkan ia mempunyai lebih banyak kelebihan berbanding dengan perisian "Minitab".

COMPARISON OF ETCHING OPTIMIZATION PROCESS BY TAGUCHI METHOD USING MINITAB AND DESIGN EXPERT SOFTWARE

ABSTRACT

A design of experiment for high throughput pad etch by reactive ion etch is reported. Design of Experiment (DOE) is a technique for optimizing process which has controllable inputs and measurable outputs. The L9 orthogonal array DOE using Taguchi method is applied for Passivation Module (Pad Etch) to obtain acceptable etch rate and smooth uniformity across the wafer. The data were simulated in two statistical softwares that are "Minitab" and "Design Expert" to obtain the optimum combination of parameters with an acceptable etch rate but reduced costs. The DOE consisted of four major varying parameters, which were RF power, CHF_3/CF_4 gas ratio, pressure and Argon flow rate. The output results which were determined by etch rate, uniformity and Ttitanium Nitride (TiN) remained, were the successful criteria considered. The dependence of the etch rate on the parameters were also analyze and it was found that the RF power and the CHF_3/CF_4 gas ratio have stronger influence on the etching rate but less influenced by the pressure and Argon flow rate. Based on the Design Expert and Minitab software results obtained, the recommended parameters for obtaining an optimized etching process were RF power of 1000 W, CHF_3/CF_4 gas ratio of 30/50, Argon flow of 150 sccm and pressure of 200 mTorr. Meanwhile, the Design Expert software is recommended to perform the optimization process as it has more advantages compared to the Minitab software.

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