POLYSILICON PROCESS DEVELOPMENT – THE EFFECT OF PECVD PROCESS PARAMETERS ON THE FILM CHARACTERISTICS

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2007

POLYSILICON PROCESS DEVELOPMENT – THE EFFECT OF PECVD PROCESS PARAMETERS ON THE FILM CHARACTERISTICS

by

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Report submitted in partial fulfillment
of the requirements for the degree
of Bachelor of Engineering

UniMAP
UNIVERSITI MALAYSIA PERLIS

MARCH 2007

ACKNOWLEDGEMENTS

Special thanks to my final year project supervisor Mr. Ramzan Bin Mat Ayub for his support and guidance. He is a very committed person to manage his work and he has been always available when I needed him. I'm also glad about his helpful comments on improving my job performance and work quality.

I would also like to express my gratitude to Mr. Phang Keng Chew, Mr. Bahari Man and Mr Haffiz Abd. Razak for their most valuable inputs and comments. I would also like to extend a lot of thanks for all staff at the fabrication lab that with their supports and helps along this project.

Finally, I would like to thank my group under the same supervision for their great support and encouragement. I hope that all of us would be able to achieve great success in all our future undertakings.

APPROVAL AND DECLARATION SHEET

This project report titled Polysilicon Process Development – The Effect of PECVD Process Parameters on the Film Characteristics was prepared and submitted by Mujahidun Bin Mashuri (Matrix Number: 041010430) 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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March 2007

PEMBENTUKAN PROSES POLISILIKON – KESAN KE ATAS SIFAT PERMUKAAN FILEM MELALUI PARAMETER PROSES PECVD

ABSTRAK

Lapisan filem polihablur silicon telah luas diaplikasikan di dalam pengeluaran produk peranti elektronik dan litar bersepadu. Pada kebiasaannya, pengendapan polihablur silicon dilakukan dengan menggunakan kaedah endapan wap kimia tekanan rendah (LPCVD) pada suhu sekitar 600 – 700 darjah celsius Melalui proses endapan yang menggunakan suhu yang tinggi ini telah menghadkan aplikasi peranti di dalam teknologi fabrikasi yang memerlukan technology pemprosesan endapan pada suhu yang rendah yang di kenali sebagai jangkauan haba. Projek ini telah mengkaji kemunasabahan penggunaan teknik endapan pada suhu yang rendah yang dikenali sebagai endapan wap kimia tertingkat plasma (PECVD) melalui amorfus silicon prapenanda pada suhu 100 – 300 darjah celsius. Struktur lapisan ini kemudiannya akan ditukar kepada struktur polihablur silicon melalui rawatan haba singkat. Kesan daripada parameter PECVD dari aspek perubahan kuasa RF, tekanan kebuk dan suhu pada lapisan filem telah dikaji. Didapati, suhu endapan dan kuasa RF mempunyai kesan yang penting pada kualiti fizikal filem dan rintangan keping akan berkurangan selepas rawatan haba singkat.

ABSTRACT

Thin polycrystalline silicon film has been used in the wide range of applications in the production of integrated circuits and other electronic products. Traditionally, polycrystalline silicon is deposited using Low Pressure Chemical Vapor Deposition (LPCVD) process at temperatures around 600 – 700C. This high temperature deposition process limits its application in the advanced device fabrication technology, which required a much lower processing technology or the so called thermal budget. This project studied the feasibility of using a lower temperature deposition technique, called Plasma Enhanced Chemical Vapor Deposition (PECVD) which deposited an amorphous silicon precursor film, at temperatures ranging from 100 – 300 C. This film is then to be converted to polycrystalline structure using a short heat treatment. The effect of PECVD process parameters which include the deposition temperature, RF power and chamber pressure on film characteristics is investigated. It was found that the deposition temperature and RF power have the most important impact on the film physical quality, and the film sheet resistivity is significantly reduced after short heat treatment.

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