

AN ABSTRACT OF A THESIS

COMPUTER MODELING OF PLANAR DIFFUSION SYSTEM (PDS) WITH BORON NITRIDE AS A SOLID SOURCE

Yewei Wang

Master of Science in Chemical Engineering

This thesis presented a useful model of hydrogen injection and subsequent water vapor dispersion in a hydrogen injection planar diffusion system based on accurate physical analysis. The formation and the dispersion of metaboric acid (HBO_2) and the thickness of boric oxide (B_2O_3) film consumption on the boron nitride (BN) surface have also been modeled. A reversible chemical reaction was considered in the space between pairs of adjacent silicon and boron nitride wafers. Computer simulations were developed to calculate the profiles of water vapor, metaboric acid (HBO_2) vapor, chemical reaction rate, and thickness of boric oxide film as a function of time, wafer radius and positions for radial spaces on the longitudinal direction. The explicit method and an International Mathematics and Statistics Libraries (IMSL) subroutine MOLCH that is based on method of lines (MOL) have been used in the simulations to solve systems of initial-value partial differential equations.

The results from the explicit model and MOLCH have been compared. The average percentage difference between two simulations of about 30%, was explained in this work. Explicit simulation was performed for different size diameters (four inches, six inches and eight inches) of wafer systems and the results of the explicit simulation were compared with different systems. The models presented in this work provide a description of the behavior of water and metaboric acid (HBO_2) vapor dispersion, chemical reaction rate, and consumption of boric oxide (B_2O_3) film on the BN surface. It established a basis for developing a more comprehensive model that includes metaboric acid (HBO_2) deposition and diffusion on the silicon wafer surface.

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A Thesis

Presented to

The Faculty of the Graduate School

Tennessee Technological University

by

Yewei Wang

In Partial Fulfillment

of the Requirements for the degree

MASTER OF SCIENCE

Chemical Engineering

May 1999

CERTIFICATE OF APPROVAL OF THESIS

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by

Yewei Wang

Graduate Advisory Committee:

Joseph J. Biemzich
Chairperson

4-21-99
Date

Clayton P. Kern
Member

April 24, 1999
Date

C. a. Ventura
Member

4/22/99
Date

David W. Garbrough
Member

April 22, 1999
Date

Approved for the Faculty:

Rebecca Quattrone
Dean of Graduate Studies

4/30/99
Date