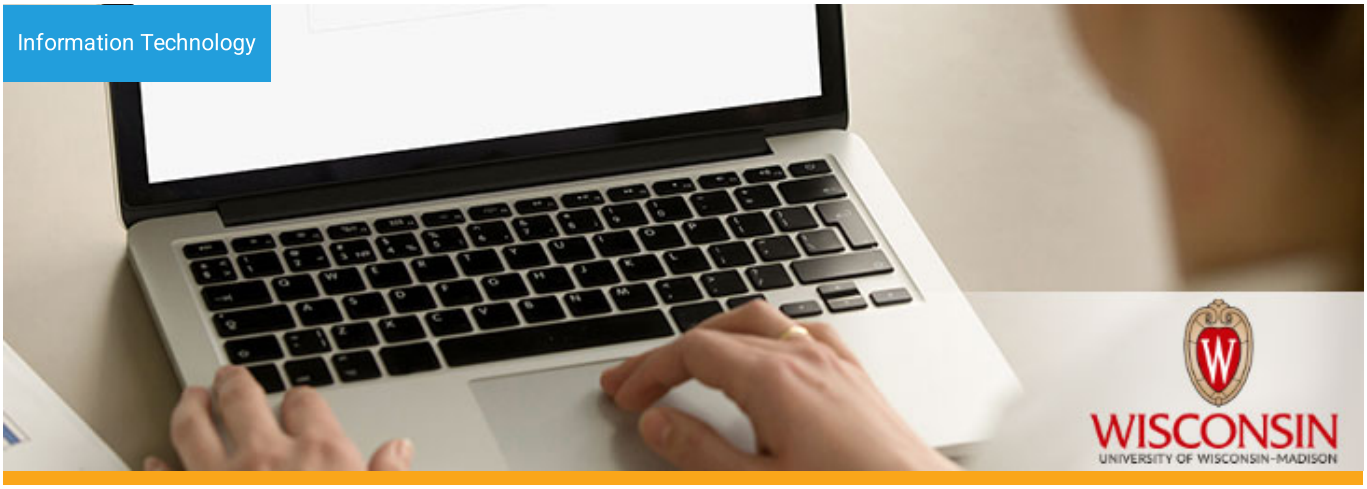
Information Technology



Determining Film Stress from Substrate Shape Using Finite Element Procedures

View U.S. Patent No. 7,418,353 in PDF format.

WARF: P03143US

Inventors: Edward Lovell, Roxann Engelstad, Zhaohua Feng

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method for analyzing the magnitude and spatial distribution of stress in thin films applied to substrates.

Overview

The fabrication of semiconductor devices involves growing thin films on wafers and patterning them. However, thin films typically exhibit intrinsic stress, which can lead to failure of electronic devices. Before film stress can be controlled, it must be measured.

The Invention

UW-Madison researchers have developed a method for analyzing the magnitude and spatial distribution of stress in thin films applied to substrates such as those used in the fabrication of integrated circuits and similar microelectronic and micromechanical devices. The method uses experimentally measured substrate shape data and finite element analysis to determine all characteristics of a thin-film stress field. First, the substrate is analyzed by itself to obtain the finite element nodal forces at the top surface of the substrate. Then the film is analyzed separately using these nodal forces as known loads to determine the stresses they will produce in the thin film.

Applications

- May be used to dynamically adjust the film application process to control magnitude and uniformity of film stress
- Facilitates production of high-quality integrated circuits and similar devices

Key Benefits

- Substrate shape data is used to accurately determine stress in thin films.
- Does not assume that film stress is uniform or the deformed substrate shape is spherical
- Suitable for a film-substrate system in which the curvature and film stress are functions of location and direction
- Particularly applicable to thin films applied to semiconductor wafers or thick substrates, such as quartz photomasks for optical lithography or low-thermal-expansion glass reticles used for extreme ultraviolet lithography

Tech Fields

- Information Technology : Computing methods, software & machine learning
- Semiconductors & Integrated Circuits : Design & fabrication

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842