Miami Dade College

Course Description

ETS2114C | Lithography Methods in Semiconductor Manufacturing | 4.00 credits

This course covers photolithography in semiconductor fabrication, focusing on pattern generation, statistical process control, and process fundamentals. Students gain hands-on experience with photomasks, spin-coating, exposure systems, and chemical development, while exploring various lithography methods and evaluating key process variables for successful pattern transfer. Prerequisites: ETS2160C - Intro to Semiconductors and Vacuum Science and ETS2163C Cleanroom Safety and Introduction to Cleanroom processing

Course Competencies

Competency 1: The student will be able to demonstrate an understanding of photolithography and pattern generation by:

1. Defining photolithography and how it fits into the broader process of semiconductor device fabrication
2. Describing the individual steps of the photolithography process such as spin-coating, exposure, and development

Competency 2: The student will be able to demonstrate an understanding of statistical process control by:

1. Identifying statistical process control and its importance in yield in device manufacturing
2. Analyzing lab-based data and interpreting the statistical significance of the results

Competency 3: The student will be able to identify the various types of pattern transfer used in semiconductor manufacturing and research and development by:

1. Identifying the process of conventional contact-based photolithography and understanding key steps of the process along with strengths and weaknesses of this method
2. Defining step and repeat (stepper) lithography and it's used in production
3. Exploring novel lithography methods such as stamping lithography, template-based approaches, and probe-based lithography
4. Learning about high resolution lithography methods such as electron beam lithography

Competency 4: The student will be able to perform the photolithography process in a hands-on fashion to apply process fundamentals by:

1. Cleaning a wafer/substrate by immersing in organic solvents, rinsing with deionized water, and drying with compressed air
2. Applying photosensitive material to a substrate and spincasting/baking the film
3. Operating an exposure system to apply UV light through a photomask to transfer patterns to the substrate
4. Performing a chemical development by immersing the substrate into a chemical developer such as CD-26
5. Determining the efficacy of the pattern transfer using basic characterization techniques such as optical microscopy and stylus profilometry

Competency 5: The student will differentiate key variables in the photolithography process and how they relate to pattern transfer by:

1. Analyzing spin speed and spin curves to understand how the spin speed of the photoresist application influences the final material thickness
2. Identifying the importance of photoresist bake steps
3. Understanding the differences between positive and negative photoresists in photolithography
4. Evaluating key development parameters in the lithography process along with common developer materials

Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning

- Formulate strategies to locate, evaluate, and apply information