

Table of Contents

1. Introduction to Semiconductor Characterization

- Purpose of material and device characterization
- Measurement techniques
- Semiconductor manufacturing overview

2. Semiconductor Material Properties

- Crystal structure and defects
- Energy band theory
- Carrier concentration and mobility
- Recombination and generation processes

3. Electrical Characterization Methods

- Resistivity measurements
- Four-point probe technique
- Hall-effect measurements
- Conductivity and mobility analysis

4. Carrier Lifetime Measurements

- Minority carrier lifetime
- Recombination mechanisms
- Photoconductivity decay methods
- Lifetime evaluation techniques

5. Capacitance-Based Characterization

- Capacitance–Voltage (C–V) measurements
- Doping profile determination
- Interface state analysis
- MOS capacitor characterization

6. Current–Voltage Characterization

- I–V measurement techniques
- Diode characterization
- Schottky barrier analysis
- Leakage current measurements

7. Optical Characterization Techniques

- Optical absorption
- Photoluminescence
- Spectroscopic methods
- Bandgap determination

8. Deep-Level Defect Characterization

- Deep-Level Transient Spectroscopy (DLTS)
- Trap identification
- Defect energy levels
- Reliability implications

9. Surface and Interface Characterization

- Surface states
- Oxide-semiconductor interfaces
- Interface trap density
- Surface recombination velocity

10. MOS Device Characterization

- MOS capacitor measurements
- Threshold voltage extraction
- Oxide charge characterization
- Reliability testing

11. Bipolar Device Characterization

- BJT electrical parameters
- Gain measurements
- Base transport analysis
- Frequency response

12. Characterization of Advanced Semiconductor Devices

- CMOS technologies
- Power devices
- Compound semiconductors
- Emerging semiconductor structures

13. Reliability and Failure Analysis

- Degradation mechanisms
- Stress testing
- Failure characterization
- Lifetime prediction

14. Measurement Instrumentation and Techniques

- Semiconductor parameter analyzers
- Probe stations
- Automated measurements
- Data interpretation

