

MOSCap Learning Materials

By completing the MOSCap Lab in <u>ABACUS - Assembly of Basic Applications for Coordinated</u> <u>Understanding of Semiconductors</u>, users will be able to a) understand the operation of a Metal-Oxide-Semiconductor using energy band diagrams, b) study the effects of interface traps, work function, oxide thickness, etc. on capacitance-voltage output, and c) understand MOS-C C-V characteristics in low and high frequency limits.

The specific objectives of the MOSCap Lab are:

MOSCAP LEARNING MATERIALS

Physical Model	Mathematical Model	Computational Model
operation.	iconductor (MOS) uency CV characteristics b) Apply mathematical to calculating:	ncy C-V characteristics of a
c) Understand and design your own MOS-C structures.		

Recommended Reading

Users who are new to the operation of MOS-Caps should consult the following resources:

1. Rober F. Pierret. (1996). *Semiconductor Device Fundamentals*. Reading, MA: Addison-Wesley. (See especially chapter 16)

Demo

- * MOSCap: First-Time User Guide
- * MOSCap Demonstration: MOS Capacitor Simulation

Theoretical Descriptions

- * Tutorial PADRE Simulation Tools.pdf (tutorial)
- * Illinois ECE 440 Solid State Electronic Devices, Lecture 31: MOS Capacitor
- * Illinois ECE 440 Solid State Electronic Devices, Lecture 32: MOS Threshold Voltage
- * Illinois ECE 440 Solid State Electronic Devices, Lecture 33: MOS Capacitance
- * ECE 606 Lecture 32: MOS Electrostatics I
- * ECE 606 Lecture 33: MOS Electrostatics II

- * ECE 606 Lecture 34: MOSCAP Frequency Response
- * MOS Capacitors: Theory and Modeling

Tool Verification

* Verification of the Validity of the MOSCap Tool

Examples

* MOSCAP Worked out problems (Basic)

Exercises and Homework Assignments

- 1. Exercise for MOS Capacitors: CV curves and interface and Oxide Charges
- 2. Exercise: CV curves for MOS capacitors

Solutions to Exercises

Solutions are provided only to instructors!

Evaluation

* ABACUS: Test for MOSCAP Tool

Challenge

* MOSCAP CV profiling