# Lecture8:
# Metal-Oxide-Semiconductor

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# Parallel plates

- A problem from “General Physics” course.
  - Consider a dielectric layer (whose thickness is $d$ and area is $A$) sandwiched by two parallel metal plates. Its permittivity is $\epsilon$.
  - A voltage difference, $V$, is applied.
  - The charges are $+Q$ and $-Q$, respectively.
  - By applying the Gauss law,

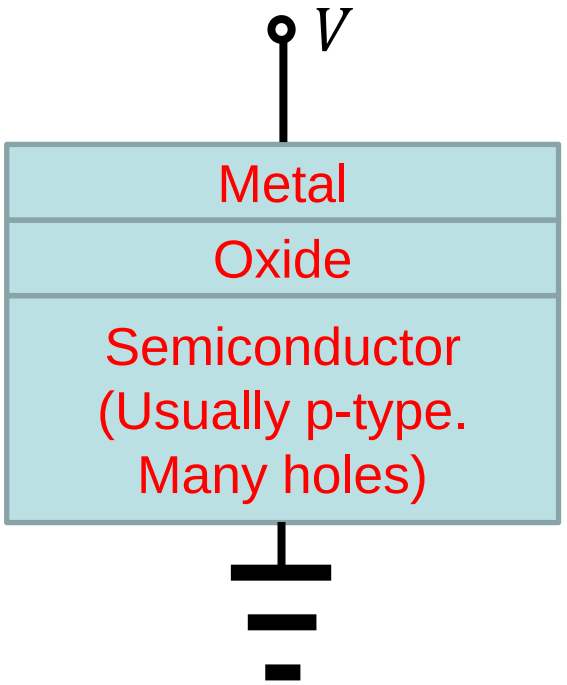
$$Q = \epsilon |\mathbf{E}| A = \epsilon \frac{V}{d} A$$

  - Therefore, the capacitance *per unit area* becomes

$$C = \frac{\epsilon}{d}$$

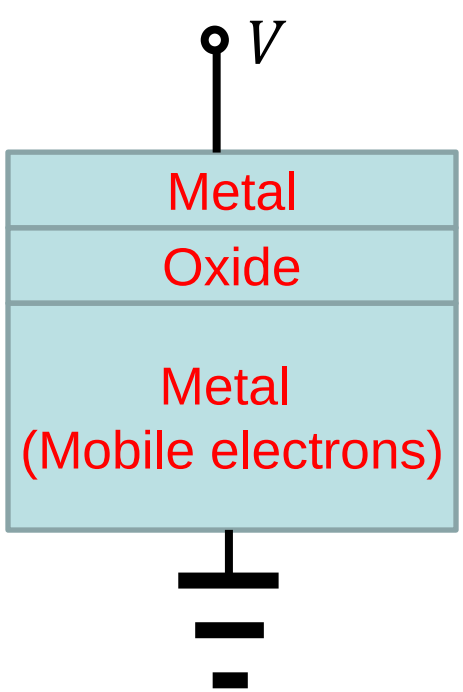
# Metal-Oxide-Semiconductor

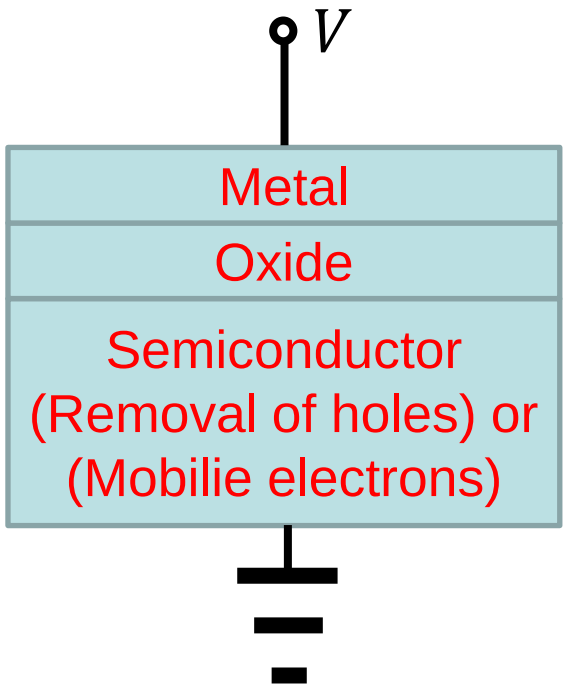
- The key structure in the microelectronics
  - Question: Is the MOS a capacitor with $C_{ox} = \frac{\epsilon_{ox}}{t_{ox}}$?
  - Answer: No. Its thickness, $t_{ox}$ →



# What is the difference?

- Threshold behavior
  - Two ways to provide negative charges
  - Removal of holes
  - Mobile electrons
- Threshold voltage
  - It is written as $V_{TH}$.
  - Most important!



# Homework#4

- Due: 09:00, April 1 (Mon)
- Solve following problems of the 2018 mid-term exam.
  - P10
  - P16
  - P17
- Solve following problems of the 2017 mid-term exam.
  - P21
  - P22
  - (The remaining problems in the 2017 mid-term exam are your own exercise. Not for HW.)