

Learning Objectives:

1. Students will be able to understand the difference between conductivity and resistivity
2. Students will be able to classify materials based on their conductivity
3. Students will be able to create various circuits using electronic ink

Topics covered:

- Lecture
 1. Conductivity and resistivity
 2. Basics of band gaps
 3. Material classes based on conductivity/band gap
- Lab
 1. Circuit basics
 2. Conductivity of various real world materials
 3. Transistors

Estimated Time for Activity:

Lecture: 20-30 minutes

Lab:30-40 minutes

Supplies Needed:

- Lecture
 - Computer with Powerpoint
 - Projector
 - Optional: iClicker/Polling software
- Lab
 - CircuitScribe basic kits
 - Two CircuitScribe super kits (for Advanced activities only)
 - Extra paper
 - Various items with different conductivities (ex: yarn, pipe cleaners, rubber bands, paper clips, tin foil, copper wire)

Recommended Prior Knowledge for Instructors:

- Conductivity and resistivity understanding
- Basics of band theory (if desired topic to cover)
- Differences between conductors, semiconductors, and insulators
- Basics of circuit design/elements

Recommended Prior Knowledge for Students:

- Bonding types
- Basic understanding of material classes

Discussion Points for Instructors:

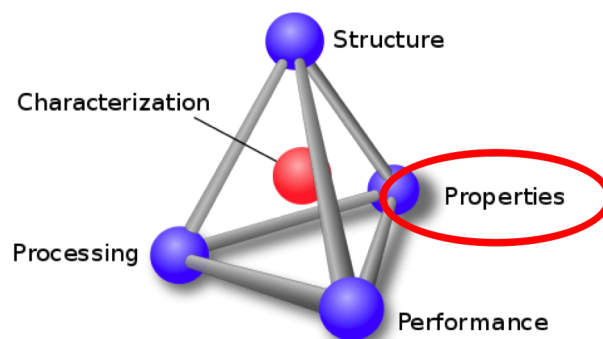
Lecture:

- How bonding effects the conductivity of specific materials
 - Why do metallic bonds aid in the conductivity of metals?

Lab:

- Basics of circuits
 - Where will the current flow within the circuit if there are two paths: one where there is a gap in the wire and one where the wire is connected? Why?
- Conductivity of various materials
 - Why is your body a conductor? Is it as good of a conductor as a metal? Why or why not?
 - Why do you need a transistor in your touch screen to use your finger as a conductor?

Aspects of Materials Science Tetrahedron Covered in Module:



Complimentary Modules

- Flag Football Belt-Bonding Simulation Activity
- Solar Cells

Files Needed

- Conductivity Lecture (PPT or pdf)
- Conductivity Instructor Lab Handout
- Conductivity Student Basic Lab Handout
- Optional: Conductivity Student Advanced Lab Handout

For K-12 Instructors:

Assessment Ideas

- Lecture
 - Utilize a word cloud through PollEverywhere – ask “What was the most interesting thing you learned?”
 - Use Think, Pair, Share for critical discussion questions regarding conductivity of various materials (ex: why do you want different conductivities in different applications?)
- Lab
 - Design check question discussion
 - Brainstorming other materials to test in the open gap circuit, including discussion of why this is a good choice

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