The Band Gap Energy and Material Classification Lesson

The Band Gap Energy

The band gap energy is the energy needed to break a bond in the crystal. When a bond is broken, the electron has absorbed enough energy to leave the valence band and “jump” to the conduction band. The width of the band gap determines the type of material (conductor, semiconductor, insulator) you are working with. This is shown pictorially using a band diagram.

Material Classification

Crystalline materials can be classified according to their band gap.

An insulator is a poor conductor since it requires a lot of energy, 5-8 eV, to excite the electrons enough to get to the conduction band. We can say that the width of the band gap is very large, since it requires that much energy to traverse the band gap, and draw the band diagram respectively.

A metal is an excellent conductor because, at room temperature, it has electrons in its conduction band constantly, with little or no energy being applied to it. This may be because of its narrow or nonexistent band gap, the conduction band may be overlapping the valence band so they share the electrons. The band diagram would be drawn with Ec and Ev very close together, if not overlapping.

Semiconductors are so popular is because they are a medium between a metal and an insulator. The band gap is wide enough to where current is not going through it at all times, but narrow enough to where it does not take a lot of energy to have electrons in the conduction band creating a current.

For a more detailed explanation, not to mention action, watch the movie .