

Diffusion Lengths Lesson

Lesson Topic: Diffusion Lengths

Objective of Lesson: To understand what is a diffusion length.

Reading Assignment: Sample Problem 2 and Section 3.5.1

What do you need to know for the exam?

1. Nothing specific except for vocabulary purposes you need to know its meaning.

Summary

Diffusion lengths arose out of solving problems like that shown in Sample Problem 2 in Chapter 3 of the text. It is a concept that will show itself to be useful with p-n junctions. Diffusion length is the average distance between the point where minority carriers are created and the points where they recombine.

Diffusion Lengths

The diffusion length is a very helpful concept. It is the average distance between the point where a minority carrier was created and the point where it recombines. Some express it as the average distance a minority carrier travels during its lifetime, but that is subtly different. After a minority carrier is generated, it immediately starts wandering around in a random walk. During that random walk the carrier could spend some time further than a diffusion length from its origin before returning just as it recombines. Also, remember that the diffusion length is an average. Some will end up having traveled farther while others will recombine immediately in the same place where they were created.

The nice thing about the diffusion length shows up when we are “collecting” carriers with a p-n junction (see later lessons). While some carriers within a diffusion length do not make it to the collection point even though they started very close, and while others further than a diffusion length from the collection point are not collected, we can simplify the analysis because the math shows us that we can assume that ALL carriers within a diffusion length are collected and all outside a diffusion length are NOT collected. As I said, this will come up again later. The integration they perform in the text in this section is a nice way of looking at it so take a good long look.

Read through the Sample Problem 2 as well so you are aware of how diffusion lengths originated in our thinking—they arose out of having a square root of diffusivity*lifetime which has units of length.