Day 1
Reflection

Preface

The challenge is all about consistency, learning, reflecting and having fun. The purpose of this Reflection is to wrap up and mention things I have learnt or summarize and reflect.

My start today was by reading the first pages of “Semiconductor physics and devices” by Donald A. Neaman. In order to understand what we’re building using those semiconductors, I wanted to build a solid foundation to learn what I am working with. Most of what I read today wasn’t new, as I took a semiconductors course in university. The purpose is to refresh and learn, and there are more new things to learn in the upcoming chapters.

The Frenkel Defect

One thing that I learned about today was the *Frenkel Defect*. Since reading chapter 1 didn’t add much but refreshed, I decided to dive deeper into this. I honestly thought the naming was unique, but it turned out to be named after its discoverer Yakov Frenkel.

Intro

Nothing’s perfect, and so do atoms. In its structure, many defects could be present. In my opinion, maybe it wasn’t the best thing to be named a defect. Maybe there is a useful use to them, I haven’t reached out to yet. It was called a defect only because it is not *perfect* like the ideal structure everybody agreed on. Maybe we could call it *unique*. Having different properties than its category.

Characteristics

So, what is a *Frenkel Defect*? It is when a vacancy and interstitial defects are close in proximity to each other, that they interact. A *vacancy* is when an atom is missing from a particular lattice site. On the other hand, an *interstitial* is when an atom is located between lattice sites.

The Frenkel Defect produces other effects than each of its constituents alone. Although it is that migrations happen, actually the overall density of the lattice decreases. [i] Although called a defect, one of its advantages is that it increases ionic conductivity in certain solids. That can be useful in solid state batteries, sensors, and semiconductor materials.[ii] An example of a material having this property is Silver(I) chloride, shown in the following figure:

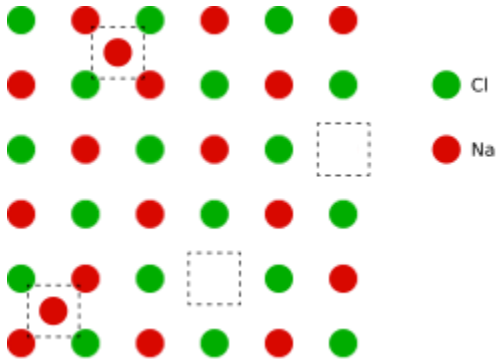

Figure 1 Two Frenkel Defects within NaCl structure

Temperature Effect

It turns out that the defect actually depends on temperature as shown in the following equation:

$$n_f = N\sqrt{N'}\, e^{\left\{-\frac{E_i}{2kT}\right\}}$$

Where N is the total number of atoms and N' is the total number of interstitial sites.

Conclusion

Not perfect doesn't always mean *bad*. It could just be another perspective on things. I might not be an expert about this topic, but I'm certain there is more to it than what I know right now.

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[i] Frenkel defect. In Wikipedia, https://en.wikipedia.org/wiki/Frenkel_defect

[ii] Frenkel Defect in Chemistry – Meaning, Diagram, Examples. Vedantu.com