Nobody is Perfect

1. Introduction

1.1 Organization

1.1.1 Use of the Hyperscript

- There are a number of special modules that you should use for navigating through the Hyperscript:
  - Detailed table of contents of the main part (called "backbone")
  - Matrix of Modules; showing all modules in context. *This is your most important "Metafile"!!!*
  - Indexlist; with direct links to the words as they appear in the modules. All words contained in the indexlist are marked **black and bold** in the text.
  - List of names; with direct links to the words as they appear in the modules. All names contained in the name list are marked **red and bold** in the text.
  - List of abbreviations; with direct links to the symbols and abbreviations as they appear in the modules
  - Dictionary; giving the German translation of not-so-common English words; again with direct links to the words as they appear in the modules. All words found in the dictionary are marked ***italic, black, and bold***. *The German translation appears directly on the page if you move the cursor on it*
- All lists are automatically generated, so errors will occur.
  - Note: *Italics and red* emphasizes something directly, without any cross reference to some list.
  - All numbers, chemical symbols etc. are written with **bold** character. There is no particular reason for this except that it looks better to me.
  - *Variables* in formulas etc. are written in italics as it should be - except when it gets confusing. Is ***v*** a **v** as in velocity in italics, or the greek ν? You get the point.

1.1.2 What it is All About

- The lecture course "Defects in Crystals" attempts to teach all important structural aspects (as opposed to electronic aspects) of defects in crystals. It covers all types of defects (from simple ***vacancies*** to ***phase boundaries***; including more complicated ***point defects***, ***dislocations***, ***stacking faults***, ***grain boundaries***), their role for properties of materials, and the analytical tools for detecting defects and measuring their properties
  - If you are not too sure about the role of defects in materials science, turn to the preface.
  - If you want to get an idea of what you should know and what will be offered, turn to chapter 2
- A few more general remarks
  - The course is far to short to really cover the topic appropriately, but still overlaps somewhat with other courses. The reasons for this is that defects play a role almost everywhere in materials science so many courses make references to defects.
  - The course has a *special format for the exercise part* similar to "Electronic Materials", but a bit less formalized. Conventional exercises are partially abandoned in favor of "professional" presentations including a paper to topics that are within the scope of the course, but will not be covered in regular class. A list of topics is given in chapter 1.2.1
- The intention with this particular format of exercises is:
  - Learn how to research an unfamiliar subject by yourself.
  - Learn how to work in a team.
  - Learn how to make a scientific presentation in a limited time (Some hints can be found in the link)
  - Learn how to write a coherent paper on a well defined subject.

- Learn about a new (and hopefully exciting) topic concerning "defects".

Accordingly, the contents and the style of the presentation will also be discussed to some extent. The emphasize, however, somewhat deviating from "Electronic Materials", is on content. For details use the link.

1.1.3 Relation to Other Courses

The graduate course "Defects in Crystals" interacts with and draws on several other courses in the materials science curriculum. A certain amount of overlap is unavoidable. Other courses of interest are

Introduction to Materials Science I + II ("MaWi I + II"; Prof. Föll)

- Required for all "Dipl.-Ing." students; **3rd** and **4th** semester
- Undergraduate course, where the essentials of crystals, defects in crystals, band structures, semiconductors, and properties of semiconductors up to semi-quantitave ***I-V-***characteristics of p-n-junctions are taught.
- For details of contents refer to the Hyperscripts (in german)
  MaWi I
  MaWi II

Physical Metallurgy I ("Metals I", Prof. Faupel)

- Includes properties of dislocations and hardening mechanisms

Sensors I

- Will, among other topics, treat point defects equilibria and reactions in the context of sensor applications

Materials Analytics I + II ("Analytics I + II", Prof. Jäger)

- Covers in detail some (but not all) of the experimental techniques, e.g. Electron Microscopy

Solid State Physics I + II ("Solid State I + II" Prof. Faupel)

- Covers the essentials of solid state physics, but does not cover structural aspects of defects.

Semiconductors (Prof. Föll)

- Covers "everything" about semiconductors except **Si** technology (but other uses of **Si**, some semiconductor physics, and especially optoelectronics). Optpelectronics needs heterojunctions and heterojunctions are plagued by defects.

1.1.4 Books

Consult the **list of books**