Cryst. Res. Technol.	37	2002	1	142

Book Review

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Tensor Properties of Crystals

Institute of Physics Publishing, Bristol and Philadelphia, 2nd Edition 1999
ISBN 0 7503 0625 4 hbk ≈110 Euro; ISBN 0 7503 0626 2 pbk ≈ 45 Euro

This textbook about the tensor properties of crystals presents on 166 pages in 8 chapters the concentrated basic knowledge which is needed for the physical understanding and mathematical description of the anisotropic properties of crystals. A brief introduction into the crystallography given in chapter 1 may not replace a crystallographic textbook but gives the most important definitions and symmetry principles for the understanding of the following. The 2nd chapter introduces in the mathematical notation of tensors and defines the basic treatment of tensors in general. This indeed very short chapter presumes already a lot of mathematical knowledge about vectors and matrices. The mathematically less routined student will need some mathematics in parallel. Nevertheless all the basic principles are mentioned. Whereas traditionally in textbooks about crystal physics the chapters are categorized straight forward by the order of the tensors, the present booklet presents in chapters 5 – 8 an ordering by the physical application but in a reliable table in the appendix various types of tensors are listed by their dimensions.

Starting in a 1st chapter with the second – rank tensors all types of conduction are summarised: thermal and electrical conductivity as well as diffusion. The crystal optics as an other important application of the second – rank tensors follows in chapter 5. For the dielectric properties of a crystal the qualities of the representation quadric is demonstrated most impressive. Chapter 4 deals with the aspects of elasticity. The forth-rank tensor is established by elasticity and is handled as an example for all the tensors with higher order. The matrix notation and the effect of crystal symmetry on the reduction of the number of components is discussed in this chapter. The well structured explanation of the principles beginning with the second rank tensors strain, stress and elasticity allow an easy understanding of the more complicated subject.

Chapter 6 is dedicated to all kind of axial tensors. Beneath the more complex transformation for various symmetry operations the reader will find examples even for higher rank axial tensors like the optical activity, gyration or magneto resistance. The importance of the electronic properties of crystals is accommodated by a good introduction into the Hall effect and its relationship to crystal symmetry. In chapter 7 about optoelectronic effects the Pockels and Kerr effect respectively are discussed for selected materials like GaAs or KDP. This may be very helpful to give the student an impression about the importance and the practical handling of tensors for the description of anisotropic properties of crystals.Some questions and problems (including the answers) at the end of every chapter are well chosen and allow a rapid self-tests about the understanding of the lesson learned.Last not least the short list of references including the personal comments of the author will be very helpful for the reader who wants to go into more detail.

In summery Tensor Properties of Crystals by D. R. Lovett presents a short but comprehensive introduction into the physics of crystals by means of tensors which is well suited for undergraduate and gradient students in the fields of solid state chemistry and physics, material sciences and crystallography.

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