Preface

This book is intended to be an introduction to physics of amorphous semiconductors for students in physics, chemistry, materials science or engineering and beginning engineers starting to work in applications of amorphous semiconductors. Amorphous semiconductors have now wide applications, for example, solar cells, thin film transistors, light sensors, optical memory devices, vidicons, electrophotographic applications etc. For further development of applications, it would be required to understand fundamental items which these applications are made on the basis of. I attempt to describe fundamental items in the light of physics of disordered systems, which are described in chapters 2 – 8. In chapters 9 – 12, the subject of matter in these chapters is described from my viewpoint although other ideas and interpretations are presented as widely as possible.

Amorphous materials have an important feature, namely, their anisotropic properties are averaged out, so that it is very difficult to clarify definitely their electronic properties. In crystalline semiconductors, for example, the nature of the localized centres can be clarified on the basis of measurements of electron spin resonance(ESR) and electron-nuclear double resonance(ENDOR) by taking data as a function of magnetic field direction with respect to the symmetry axis, while , in amorphous semiconductors, it is generally difficult for ENDOR measurements to lead us to a definite conclusion, because the ENDOR spectra do not consist of sharp lines, instead broad lines reflecting the distribution of the symmetry axes arising from disordered networks. From such situations,

we have many issues to be controversial, for example,the nature of trapping and recombination centres, the recombination processes, and the light-induced defect creation in a-Si:H. So, in chapters 9 – 12, those experimental results which seem important to understand the above-mentioned issues are presented and then several models reported so far are described to account for the experimental results. For the light-induced phenomena, emphasized is the role of electron-phonon interactions, so that a chapter concerning this subject is included.

At present, much attention is paid on artificial materials made from crystalline semiconductors from the viewpoints of physics and applications. Amorphous semiconducting artificial materials have also been fabricated since 1982. Chapter 13 is devoted to the description of these materials with a hope for them to be further developed as promising materials for the future devices. This field is also of particular interest from physics of disordered systems in the sense that there is an interplay between the periodic superstructure and the random arrays of atoms.

This book is also intended to be useful for researchers working in the field of amorphous semiconductors. For this purpose, chapter 14 is devoted to summarize principal properties of amorphous silicon and related materials and also of chalcogenide glasses, particularly on their electronic properties. It also includes up to date data, particularly on amorphous silicon and related materials as widely as possible, but, of course, it is impossible to include everything. Thus the reader is referred to Proceedings of 17th International Conference on Amorphous and Microcrystalline Semiconductors held in Budapest, 1997 that has been published in Journal of Non-Crystalline Solids Vol. 227 – 230, 1998.

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