It is obvious that a book by so many authors contains much overlapping material. The deadlines, known and feared by each teacher at a summer school, cause some papers to be less careful than usual. Nevertheless, the coverage of the subject, the choice of authors and material and the level of the contributions is very good. Nowhere else can such a wealth of material on electron and magnetization densities be found in a single volume. Each scientist active in the field should have easy access to the book and no student doing research on the subject should continue without reading the appropriate chapters, if not all of it. The publisher has made this possible by bringing out a well printed book at an acceptable price.

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The nature of the surface chemical bond. Edited by T. N. RHODIN and G. ERTL. Pp. xii + 405, Figs. 105, Tables 22. Amsterdam, New York, Oxford: North-Holland Publishing Company, 1979. Price $58·50, Dfl 120.00.

This book deals with various theoretical and experimental aspects of the bond between metal surfaces and chemisorbed species. It contains an *Introduction* and five chapters, written by different authors. Two chapters (about 50 pages each) give theoretical considerations; one of 160 pages reviews the various electron spectroscopic techniques applied to chemisorption; one chapter (36 pages) deals with surface crystallography; the last part (68 pages) considers the energetics of chemisorption.

There are two main streams in the theoretical description of the electronic structure of surface–adsorbate systems: the solid-state physics point of view and the approach from quantum chemistry. T. B. Grimley, in the first chapter, gives a very lucid account of some theoretical techniques of importance within the first tradition, confining himself entirely to molecular orbital schemes, however; R. P. Mesmer in chapter 2 gives a nice overview on the theoretical methods originating from a quantum-chemical way of thinking. The latter author, after having given a comparison of the existing theoretical models, particularly considers the cluster-model theory and its application to some chemisorption systems.

The chapter on electron spectroscopy and surface chemical bonding written by T. N. Rhodin and J. W. Gadzuk reviews the most effective electron spectroscopic techniques as they are applied to obtain factual information on the surface chemical bond: ultraviolet photoelectron spectroscopy, X-ray excited photoelectron spectroscopy, Auger-electron spectroscopy and high-resolution electron energy-loss spectroscopy. The authors give a well-balanced overview on the theoretical and experimental principles of these spectroscopies. This is followed by a discussion of the experimental results obtained for typical gas–metal chemisorption systems, illustrating the specific types of information available.

M. A. Van Hove, in a chapter on surface crystallography and bonding, presents a systematic summary of the surface geometrical information obtained with low-energy electron diffraction.

The last contribution by G. Ertl on the energetics of chemisorption on metals is an account from a (physical) chemist's point of view. This author considers the microscopic features of the energetics of chemisorption. Basic subjects from catalysis such as the ensemble and ligand effect, surface stoichiometry, surface steps, activation barriers, interaction between adsorbed particles are extensively discussed within the context of the main theme.

The book as a whole gives a well integrated and documented account of the current areas of research around the central theme of the surface chemical bond. Although most of the contributions cover the literature until the end of 1977 only, the book may very well be used by graduate students and research scientists as a point of departure for entering the subject and for obtaining a good perspective on this area of intense scientific activity.

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Crystals – growth, properties and applications, Vol. 2. Edited by H. C. FREYHARDT. Pp. 199. Berlin, Heidelberg, New York: Springer-Verlag, 1980. Price DM 88.00, US $52.00.

This volume contains four dissimilar articles connected only by the thread that they are concerned with aspects of crystal growth.

The first article by K. & J. Nassau is a very timely review concerned with *The growth of synthetic and imitation gems.* This is a good introduction to the field which gemologists and those increasingly involved in relating natural minerals to controlled laboratory experiments will find very useful. Many others will find it a review of some fascination since it covers not only the techniques used for crystal growth but also the properties that make a material suitable for gem use. The fundamentals of gems and gemology are also usefully outlined.

The second article is by E. Schönherr and is an extremely practical review entitled *The growth of large crystals from the vapour phase.* Many workers in universities or research institutes commencing work on growing crystals sufficiently large for research study should find this a valuable aid in choosing the techniques and equipment most appropriate to their needs and in interpreting the crystal morphologies which can be produced. The discussion is restricted mainly to crystals which evaporate congruently but the methods described can also be applied to growth by dissociative sublimation and chemical transport.

The third article by D. E. Ovsienko & G. A. Alfintsev is a highly specialist review detailed as *Crystal growth from the melt – experimental investigation of kinetics and morphology*. It presents a mass of experimental data covering a wide range of substances. In addition to the coverage of the kinetics and morphology of crystals grown from the melt, the incorporation and influence of impurities and the formation of unstable growth shapes are also discussed.

The final article by A. H. Morrish examines *The morphology and physical properties of* γ-Fe_2O_3, a material widely used for magnetic recording devices. This is also a specialist article but gives thorough coverage to the field whilst being concisely written. It summarizes preparative methods and appropriate physical properties as well as discussing the role of dopant additives.

In summary, this volume contains two articles which will be of general interest to crystal-growth scientists and two limited to a more specialist appeal. All four articles are comprehensively referenced and the diagrams, photographs and tables are clearly presented throughout.

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Ill-condensed matter. Edited by R. BALEAN, R. MAYNARD and G. TOULOUSE. Pp. xxv + 607. Amsterdam: North-Holland, 1979. Price US $97.50, Dfl 200.00.

This book is the outcome of the XXXI session of Les Houches Summer School which was held during the period 3 July–18 August 1978. The topic of the meeting was amorphous materials, but the volume is archly labelled *Ill-Condensed Matter*. This label is slightly better than 'non-crystalline', which tells us what the material is not, but it implies that something has gone astray in the assembly of atoms, thereby forming a structure with holes, like Swiss cheese. As a matter of fact, the cheese analogy (Gruyère was chosen, since the meeting was, after all, in France) is used in introducing percolation theory but the use of the term ill-condensed to describe materials which exhibit only short-range correlations was probably ill-advised since crystalline materials can also be ill-condensed in the sense that crystals may contain imperfections such as vacancies, dislocations and voids. With this cavil aside, however, the strength of the book lies in the depth of treatment of the topics which it covers and the weakness lies in several glaring omissions in topics which should have been covered in any general treatment of the subject. This was a summer school, with substantial sponsorship, and with the luxury and leisure to examine amorphous materials in a comprehensive fashion, but this was not to be the case.

The book begins with a good treatment of percolation theory by David Thouless of Queens University in Canada. Percolation is introduced by considering a solid which has a random distribution of small holes. If the number of holes is small there will only be a small number of overlapping holes, but as the concentration of holes increases the average size of overlapping clusters increases until at some critical concentration there is an infinite cluster. At this point, fluid can percolate from the exterior to the interior. Percolation processes can be considered for a regular lattice, but the concepts are also applicable when a lattice cannot be defined. The percolation problems can be defined as a site problem or as a bond problem with the corresponding probabilities of empty atomic sites or unoccupied bonds. Electrical network problems, antiferromagnetic behaviour, scaling and renormalization and spin-wave stiffness problems are discussed. Amorphous materials are approached by considering the concept of localization by disorder, by which Thouless simply means to describe a material with local atomic order. At this point the Anderson model of disordered solids is introduced as essentially a tight-binding model in which the disorder is induced by letting the binding energy vary from site to site, and the remainder of the chapter focuses particular attention on the electrical transport properties in such materials. What is percolating in these cases? The atoms are ignored, and we consider the percolation of electrons, holes and spins through vacant sites. The author has an interesting point of view on the correlation of experiment with theory. He considers the interpretation of experimental information to be ambiguous and prefers to compare theory with computer simulations. It would appear that such an approach provides greater comfort to the theorists.

At this point, it is best to go to chapter 3, *Lecture on amorphous systems* by Philip W. Anderson of Bell Laboratories. It would have been better to start the volume with this paper, since it presents a good general introduction to phenomena which are uniquely associated with glasses. He makes an important point in stressing the non-ergodicity of these materials in the sense that they do not move uniformly through phase space and that averages over all possible states are not applicable. Anderson discusses the glass transition, the electronic structure of glasses, spin glasses, renormalization, and transport problems. There is no attempt to provide rigor in any of these topics, but it all seems very plausible and is good reading.

One should then proceed to chapter 5, *Models of disordered materials* by Scott Kirkpatrick of IBM. The author takes up the percolation problem in amorphous materials, with particular attention to two-dimensional bond percolation. Here also, theory is compared to computer simulations. Random magnets and conduction are discussed along with such topics as spin glasses.

These three chapters define the core of the conference. The rest is a mixed bag. There is a review of physical phenomena in glasses by Joffrin (chapter 2) and an interesting chapter on algebraic topology by Poenaru (chapter 4). One either likes topology or one does not; I happen to like it, and a certain amount of intellectual broadening is certainly welcome in a summer school. The rest of the book considers such topics as critical phenomena in disordered systems and short summaries of a variety of other experimental and theoretical topics.

The overall effect of the book is vaguely unsatisfactory. At no point is there a discussion of the atomic arrangement in these disordered systems. The arrangement is implied only in terms of electrons and electron holes or spins, and the percolation of these electronic entities. There is considerable discussion of binding and bonding but no mention of what