There is rather comprehensive coverage of the myriad of techniques used in surface science so that the reader is exposed to the spectroscopic methods currently available and their typical applications. Necessarily, the discussion of the large number of topics is somewhat superficial. A student who would actually use one or more methods would most certainly need to read more broadly. While the bibliography serves as a good starting point for more in-depth reading, it is not comprehensive because of the large number of topics discussed in the book. Only selected examples are referenced on a given topic, e.g. the study of activated adsorption using molecular beam techniques. Therefore, if the reader or instructor of a course wishes to go beyond the text, an independent review of the literature will be necessary in many cases.

The text is also a useful overview of the developments in the field of surface chemistry for experienced researchers in surface physics and related fields. Results of experiments performed over the past two decades are synthesized into a general framework. The overview serves as a conceptual basis for the vast research encompassed in the area of surface physics and induces one to cast current work within this framework.

Overall, *Physics at Surfaces* is an excellent introduction to the emerging and developing field of surface science from which both students and experienced researchers will benefit.

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Metallic Superlattices—Artificially Structured Materials. Edited by *T. Shinjo* and *T. Takada*. Elsevier, Amsterdam 1987. xii, 271 pp., bound, DFl 240.00.—ISBN 0-444-42863-1

Advances in ultrahigh-vacuum deposition techniques have made possible the sequential monolayer-by-monolayer deposition of artificially layered materials including semiconductors, metals, etc. This volume 49 of the series "Studies in Physics and Theoretical Chemistry" is a collection of review papers on artificially layered metal structures presented by several principal investigators. The majority of the authors (five out of eight) are university professors in Japan, so that the book has a somewhat eastern asian flavor, although the research activities in this field are equally spread all over the industrialized world. However, with the recent rapid growth of activity on artificially layered materials and the concomitant dramatic increase in the number of published papers, finding a book that can serve as a comprehensible text for an introductory course is particularly important. This book addresses that purpose very well, and it is to be highly recommended for that use, as well as to the individual reader seeking an introduction to one of the special topics discussed in five of the chapters.

The book consists of seven chapters: 1. Overview of metallic superlattices (*T. Shinjo*), 2. X-ray diffraction studies on metallic superlattices (*Y. Fujii*), 3. Neutron diffraction studies on metallic superlattices (*Y. Endoh*, *C. F. Majkrzak*), 4. Mössbauer spectroscopic studies on superlattices (*T. Shinjo*), 5. NMR studies on superlattices (*H. Yasuoka*), 6. Superconductivity in superlattices (*V. Matijasevic*, *M. R. Beasley*), 7. Theories on metallic superlattices (*K. Terakura*). Much credit must be given to the editors for providing an extensive list of element combinations used in layered metallic structures and a comprehensive bibliography in the appendix.

In the areas covered this fine book is close to being a state-of-the art summary of current research.

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High-Resolution Solid-State NMR of Silicates and Zeolites. By *G. Engelhardt* and *D. Michel*. John Wiley & Sons, Chichester 1987. xiv, 485 pp., hardcover £ 55.00.—ISBN 0-471-91597-1

For many years solid-state NMR spectroscopy was regarded merely as a tool for specialists in the shadow of the more important magnetic resonance applications to the liquid state. This changed after novel sophisticated high-resolution techniques such as magic angle spinning (MAS) and multi-pulse experiments were developed for solid materials. Nowadays multinuclear high-resolution solid-state NMR spectroscopy is attracting increasing interest in chemistry, materials science and many other domains. The new book by *G. Engelhardt* and *D. Michel* gives a survey of one of the most important applications, i.e. that to silicates, aluminosilicates, zeolites and silicate sorbents. It is an excellent introduction to high-resolution solid-state NMR spectroscopy in general, and gives an overview of current research activities in silicate and zeolite science in particular.

The text is organized in seven chapters beginning with a short introduction to the historical background. Chapter 2 treats the basic principles of high-resolution NMR of solids. The nuclear spin interactions affecting the spectral features are described in the irreducible tensor notation, and the most important experimental techniques (MAS, cross-polarization, dipolar decoupling, multi-pulse methods) are briefly discussed. The peculiarity of adsorbed molecules is emphasized. Since detailed information about the structure of species containing silicon has been obtained from studies of the liquid state, the third chapter of the book is completely devoted to ^{29}Si NMR of silicate solutions.

The next two chapters deal with general aspects and applications of ^{29}Si and ^{27}Al NMR studies of silicates, aluminosilicates and zeolites. Experimental methods, general features of the spectra, spectral parameters and correlations with structure are discussed in Chapter 4, whereas Chapter 5 summarizes the large amount of data that have already been accumulated from studies on natural and synthetic silicate and aluminosilicate materials and zeolites. In addition to crystalline materials and especially zeolites, other materials included are glasses, layer silicates, silica polymorphs and tectoaluminosilicates.

Chapter 6 focusses on NMR studies of nuclei other than ^{29}Si and ^{27}Al in zeolites and non-zeolitic silicates. The topics covered are ^{11}B NMR studies of borosilicates and borozeolites, ^{17}O resonances of framework oxygen, NMR of charge-compensating cations, and ^{13}C and ^{1}H studies of zeolites. The final chapter is devoted to high-resolution NMR of adsorbed molecules. Adsorption on zeolites, silica surfaces, silicates and aluminosilicates, and diamagnetic and paramagnetic adsorption sites are considered. Most work discussed in this chapter deals with ^{1}H, ^{13}C, ^{15}N, and ^{129}Xe resonances.

The book as a whole is well organized and gives useful information for anyone who is interested in the wide range of applications to silicates, zeolites, and all kinds of adsorbed systems. But it is equally important for NMR spectroscopists who are already engaged in studying crystals and glasses and plan to extend their activity to new techniques and materials. Particular emphasis is given to all types of chemical information obtainable from the spectra, but the treatment is by no means confined to a purely descriptive presentation. A real advantage of this monograph is that it is readily comprehensible to chemists, while at the same time including the necessary physical background. Zeolite and silicate scientists will appreciate the wealth of literature references given in connection with the various NMR applications. Without hesitation this book may be recommended as an excellent approach to high-resolution solid-state NMR spectroscopy. It should not be considered as an alternative to *Colin Fyfe*'s "Solid-State NMR for Chemists", but as a useful supplement with emphasis on inorganic silicates and a more physico-chemical style of description.

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Inorganic Thermochromism. By *K. Sone* and *Y. Fukuda*. Springer, Berlin 1987. xi, 134 pp., bound, DM 168.00.— ISBN 3-540-17662-4

The color change of chemical species with temperature is a widespread phenomenon and can be traced back to a variety of causes. The book of *Sone* and *Fukuda* concentrates mainly on the thermochromism of transition metal complexes in solution which results from changes in the crystal field. The introductory chapter defines the subject and gives some instructive examples, including the red to violet to green color change of Cr^{3+} doped α-Al_2O_3 with increasing temperature. Chapter B considers chromotropic phenomena, mainly of cobalt(II)chloro complexes, which result from the tetrahedral-octahedral interconversion and from ligand exchange reactions in various protic and aprotic solvents (including an analysis of inert salt effects). The color shift from the blue tetrahedral $CoCl_4^{2-}$ to the pink octahedral $Co(OH_2)_6^{2+}$ complex is a well known example of this category.

Chapter C concentrates on nickel(II) chelates in solution. An analysis of the spectral changes which accompany the conversion of paramagnetic octahedral, square pyramidal and tetrahedral to diamagnetic square-planar complexes is given. Interconversions of this type which depend on the donor properties of the solvent are extensively discussed. Geometrical changes of this kind may also occur within monomer-polymer equilibria. Finally isomerization reactions (nitro-nitrito) are mentioned. The next chapter is devoted to the thermochromism of copper(II) complexes. They are geometrically extremely variable as a consequence of the Jahn-Teller effect of the d^9 configurated central ion, and change their coordination sphere rather continuously from elongated octahedral or square pyramidal to square-planar—in line with corresponding color shifts.

Chapter E comprises miscellaneous chromotropic phenomena of other transition metal complexes in solution. Thermochromism may be observed, for example, in octahedral Fe^{II} or Fe^{III} complexes if the ligand strength is very near to the critical value of the ligand field parameter, which determines the transition from the high-spin to the low-spin configuration. Equally interesting is the color change which accompanies the addition of a second axial ligand to square-pyramidal $[OV^{IV}(acac)_2]$ complexes. The last chapter outlines the thermochromism of transition metal complexes in the solid state. After considering irreversible reactions caused by thermal dehydration, desammination and isomerization, a few examples of reversible thermochromism are presented. In particular, the compressed tetrahedral-square-planar interconversion of $Cu^{II}L_4$ complexes, which often occurs continuously with temperature, is discussed and compared with the discontinuous (but also reversible) change from a tetrahedral to an octahedral coordination in the case of Ni^{II} complexes. Finally, the fluorescence thermochromism of certain $copper^{I}$ complexes is mentioned, and a short section describes the application of thermochromic compounds as color indicators for temperature changes.

The book under review is the first attempt to give a rather thorough description of the exciting world of thermochromism and related chromotropic phenomena in inorganic chemistry. It is easy and enjoyable to read, and will certainly be extremely informative for scientists and graduate students who are involved in the spectroscopy of transition metal complexes and compounds in solution or in the solid state. Because the authors have themselves been engated for many years in the solution chemistry of transition metal complexes, the main emphasis is laid upon this subject; the equally fascinating thermochromism of solid compounds is unfortunately not very extensively treated. Although the authors state in the preface that this was not their intention, the book would have fulfilled its purpose even more effectively if there had been a higher degree of sophistication in the discussion of the physical basis of the thermochromic properties, and an even stronger emphasis on the correlation of these properties with the electronic structures of the transition metal ions involved. However, this is a book with many merits, which can be warmly recommended to all chemists who are interested in and fascinated by color phenomena in inorganic chemistry.

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