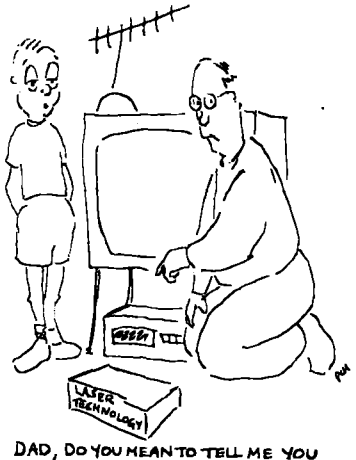
weekend or for the evening and, in many cases, we return to work with the briefcase untouched because we were too tired in the evening and we needed some relaxation over the weekend. The video-quick-education may change this situation for the better or worse (who knows?).

After coming home from a long day, I had in my briefcase—among other things—the above video educational quicky (17 minutes) on 'Laser Technology'. The activation barrier of watching a video tape is low—in the case of this video tape, the message is presented at a level which is easy to understand and the pictures are fascinating. When my 16 year old son joined me at the TV and saw the pictures of a laser beam cutting through metal and welding steel he made the following remark: "Dad, I didn't know that your work was so interesting."



Now back to the content of the video cassette which was put together by the VDI (Verein Deutscher Ingenieure; German professional society of engineers) and which was sponsored by the BMFT (Germany Ministry of Research and Technology). The tape starts with a description of the main mechanisms of the laser, introducing words like 'stimulated emission' and 'inversion' without going into the intricacies of explaining why inversion can, in most cases, only be achieved by quite complex atomic schemes. Also the words 'coherence' and 'monochromaticity' are described on a rather qualitative level.

The video tape shows in greater detail and with very good graphical documentation technical applications like cutting, welding and surface hardening. For that purpose the main laser-tools are introduced briefly: The CO_2 laser, the solid state laser and the excimer laser. The subsequent applications are commented on from an engineering viewpoint and are very helpful for those who wonder why lasers are, in many cases, superior to conventional techniques for welding and hardening: it is the ease of handling the light beam via lightpipes and the ease of focusing power on a narrow spot or dissipating power in a thin layer. All the above features reduce the thermal stress which conventional methods often cause. So—all in all—the video cassette is, in my opinion, a success and its application will expand in the near future.

The only critical remark concerns the title. The title should be: 'Laser Technology in Materials Processing'. What has been left out are large areas of laser technology and laser applications. *Semiconductor lasers* which are in every laser printer which we use on a daily basis and lasers in data processing and communication technologies (glass fiber techniques) are completely omitted. This may reflect on some less developed areas of the German engineering menu or it may just be that the authors of the cassette forgot to implement the above area of 'information technology'. These are, however,—without doubt—part of the engineering sciences.

Since medical applications are also missing in the tape we come to the conclusion that it may be rather difficult to treat the full subject of 'laser technology' in one tape.

The only part of the tape which goes beyond materials technology is the part on holography; but that would have to be expanded because there are also optical memories and holographical optical schemes for storing and processing information, let alone the question of whether the complex subject of 'pattern recognition' by holographical schemes could be part of an educational tape.

In summary I think that the video tape is a success and—if it were not for the misleading title—I would rate it as excellent because I think that it will stimulate others to describe science and technology in a way which we can handle in the time between coming home and dinner. It may make our lives easier or the opposite—to answer this question I would have to consult my wife.

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Inverse Gas Chromatography. Characterization of Polymers and Other Materials. Edited by *D. R. Lloyd, T. C. Ward,* and *H. P. Schreiber,* ACS Symposium Series 391, American Chemical Society, Washington, DC 1989. xi, 318 pp., bound, US $ 83.95. – ISBN 0-8412-1610-X

The book originates from a Symposium on Polymer Characterization held in Toronto, Canada in June 1988. As mentioned in the Preface, it contains 19 of 20 papers presented there, and three additional chapters were incorporated to broaden the scope of the book.

Inverse Gas Chromatography (IGC), first mentioned in 1966 as an analytical technique for studying bulk samples, has developed since then to become a viable and powerful method for the investigation of surface and bulk properties, especially of polymer materials. The name for this chromatographic technique was coined because the material under investigation is not introduced as a (temporary) component of the mobile phase, but it constitutes—at least in part—the

stationary phase. The aim of the experimenter is not the separation of a mixture of injected compounds but to inspect the retention behaviour of molecules introduced as probes in order to obtain information on the interactions between a probe molecule and the substrate under investigation.

The book reviewed here is the first to focus exclusively on IGC and therefore merits attention if for no other reason. Moreover, the editors have been successful in collecting contributions which cover a variety of applications which make obvious the wide spectrum of applications of the method.

The first, introductory chapter, written by two of the editors (*D. R. Lloyd, H. P. Schreiber*), gives a short overview of IGC and, in particular, of the contents of the volume. The remaining 21 chapters are divided into six sections. Chapters 2–4 are concerned with methodology and instrumentation. The next three sections focus on sorption and diffusion in polymers (4 chapters), polymer blend characterization (4 chapters), and surface and interface characterization (6 chapters). Analytical applications and special applications (2 chapters each) are covered by the last two sections.

The methodology and instrumentation section starts with a chapter by *A. E. Bolvari, T. C. Ward, P. A. Koning*, and *D. P. Sheehy* describing experimental techniques for IGC. Column techniques and their advantages and disadvantages are discussed: capillary columns (the substrate is coated on to the inner wall of the capillary), packed columns (packed with a solid support on to which the polymer has been coated) and fiber columns (the column is packed with the polymer fibers). In addition, some instrumental aspects are briefly considered, including the necessity for automation in IGC. Automation is also the subject of chapter 3 (by *J. E. Guillet, M. Romansky, G. J. Price*, and *R. van der Mark*). The authors give a review on fundamental aspects of measurements by IGC, such as the determination of transition temperatures, crystallinity, solubility, interaction parameters, surface areas, and adsorption isotherms. In chapter 4 (by *P. Hattam, Q. Du*, and *P. Munk*) results from a computer simulation study of the elution behavior of probes are compared with experiment. This study aims at improving the "quality" of the conclusions that can be drawn from IGC data.

In the next section, sorption and diffusion processes in polymers are covered. Chapter 5 by *G. J. Price* is concerned with an important application of IGC: the determination of solubility parameters δ. The author shows very interesting results; unfortunately, not a single equation is given which correlates variables measured by IGC to thermodynamic functions. Thus, it remains unclear from this chapter how the δ values have been calculated. The next chapter (by *B. Shiyao, S. Sourirajan, F. D. F. Talbot*, and *T. Matsuura*) is concerned with adsorption measurements on cellulosic materials and on polyethersulfone. Different gases and vapors of organic compounds were used as the probe molecules. Of particular interest are the results obtained with binary mixtures of gases and vapors. Thermodynamics of water sorption by two copolymers composed of vinylidene chloride and vinyl chloride or acrylonitrile are the subject of chapter 7 (by *P. G. Demertzis* and *M. G. Kontominas*). In addition to thermodynamic parameters of sorption (free energy, entropy, enthalpy, and activity coefficient), diffusion coefficients and activation energies for the diffusion of water vapor in the two copolymers were calculated from the chromatographic data. Solute diffusion in polymers is also the subject of the last chapter in this section. *D. Arnould* and *R. L. Lawrence* report on measurements carried out with different probes and polymethyl methacrylate as the substrate; the capillary column technique was used. The results are discussed with respect to the mechanism of diffusion and to the validity of different models of the diffusion process.

The next section starts with a chapter by *G. DiPaola-Baranyi* on studies of the thermodynamics of polymer blends by IGC. Three binary blends were studied at different compositions; thus interaction parameters were obtained as a function of the composition of the blends. It will be interesting to see the remarkable results confirmed by other techniques. That care has to be taken with experimental and data acquisition techniques in IGC when studying polymer blends is a conclusion drawn in chapter 10 by *M. J. El-Hibri, W. Cheng, P. Hattam*, and *P. Munk* from their theoretical and practical work. Phase diagrams for two polystyrene blends as based on IGC data are shown by *S. Klotz, H. Gräter*, and *H.-J. Cantow* in chapter 11. These authors report that a correct interpretation of the thermodynamics of mixtures of molten polymers can be obtained via IGC. *A. C. Su* and *J. R. Fried* (chapter 12) compared—on the basis of IGC data—the miscibility of the components of two binary blends and found the results to be in agreement with conclusions from studies on thermal and mechanical behavior.

The next four chapters deal with the surface and interface characterization of carbon fibers. *A. J. Vukov* and *D. G. Gray* (chapter 13) studied the dependence of surface characteristics on pretreatment at different temperatures, while *S. P. Wesson* and *R. E. Allred* (chapter 15) report on the surface energetics of plasma-treated fiber. In the contributions of *J. Schultz* and *L. Lavielle* (chapter 14) and *A. E. Bolvari* and *T. C. Ward* (chapter 16) adhesion between carbon fibers and different matrices is correlated with acid-base interactions. Altogether, these four chapters give an extensive overview on surface and adhesion properties of carbon fibers. Acid-base interactions are also shown to play an important role in adsorption of polymers on glass surfaces, as demonstrated by *E. Osmont* and *H. P. Schreiber* in chapter 17 for glass materials with differently treated surfaces. In the last chapter of this section, *E. Papirer, A. Vidal*, and *H. Balard* report on the use of IGC for the determination of surface energy characteristics of silica materials of different polarity, as obtained by heat treatment or by grafting reactions.

The next section (Analytical Applications) contains two chapters dealing with the characterization of polymers which can be used as stationary phases in gas chromatography. *R. J. Laub* and *O. S. Tyagi* made use of the correlation between retention and saturation vapor pressure of different solutes for characterizing the stationary phase. In chap-

ter 20, *J. H. Raymer, S. D. Cooper,* and *E. D. Pellizzari* compare the retention properties of four polyimide-based materials and a well-established polyphenylene oxide stationary phase by means of a deuterated tracer pulse technique.

The last two chapters are combined in a "Special Applications" section. *P. H. Neill* and *R. E. Winans* (chapter 21) report on the use of IGC to determine the alterations that coals and oxidized coals undergo when heated to 450 °C. Interpretation of the observed effects is made on the basis of results obtained by pyrolysis, plastometry, and microdilatometry. The final chapter of the volume (by *S. G. Gilbert*) deals with the determination of water sorption isotherms of starch materials.

A general drawback of multi-authored books also applies to this volume: although the contributions are well written, some information can be found in almost every chapter whereas other useful information may have been omitted. Unfortunately, the work which has been done by the editorial staff cannot be recognized by the reader of the book since he does not know anything about the original versions of the contributions. Nevertheless, contributions to a book should be "harmonized" to a certain extent. Thus, symbols should be used consistently throughout the volume. In this book, however, almost every author uses his own special symbols (e.g., five different symbols are used for the hold-up or dead time). Another example: Figure 3 of chapter 14 appears again in a much better version two chapters later; the latter version alone would have been sufficient. Finally, the last chapter is only of minor quality compared to the other chapters; in fact, it looks like a manuscript for an oral presentation, the figures are not explained in the text, and "the product tcKt" turns out to be a product of the factors "tc" and "Kt"!

Only a few errors have been observed (e.g., sub- and superscripts are missing with the symbols and units of Table 1 in chapter 13, and the heading of the last column of Table I in chapter 14 should read "γ_s^P" instead of "γ_s^D"). The subject index is of sufficient length (but, as an example, the entry "absorption" is missing). The reference lists of the individual chapters cover the literature until the beginning of 1988, thus providing the reader with information also on recent work.

In all, the book contains a wealth of highly interesting information, and it will be of value for specialists in the field as well as for the interested newcomer.

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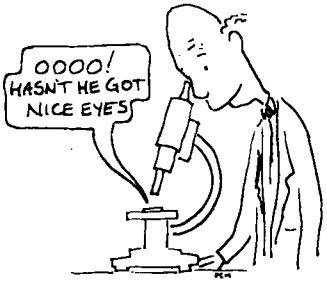
Transmission Electron Microscopy. By *L. Reimer.* Springer Series in Optical Sciences, Springer-Verlag, Second Edition, 1989, xiii, 547 pp., paperback, DM 128.–ISBN 3-540-50499-0

In 1906 *J. J. Thomson* was awarded the Nobel Prize for demonstrating that the electron was a particle. Thirty-one years later his son, *G. P. Thomson,* was awarded the Nobel Prize for demonstrating that the electron was a wave. In 1986 *Ernst Ruska* was awarded the Nobel Prize (long overdue) for utilizing both the particle and wave properties of electrons in designing the first electron microscope in 1931.

Electron microscopes are amongst the most widely used and the most important scientific instruments. They are essential equipment for biologists, chemists, geologists, materials scientists, physicists and others. There are many books on the subject, but this book by *Reimer* is, quite simply, the best. This second edition is a revision of his earlier book on Transmission Electron Microscopy (TEM), first published in 1984. In the last five years the field of TEM has expanded enormously and this revision very thoroughly updates and extends growth areas such as electron holography, lattice imaging with atomic resolution, electron energy-loss spectroscopy, etc.

The scope of the book covers both TEM and analytical electron microscopy. Even subjects like reflection electron microscopy from surfaces are discussed. Contents include the types of electron microscopes available, particle optics and electron lenses, wave optics, imaging, scanning transmission electron microscopy (STEM), electron-specimen interactions, contrast theory, high resolution electron microscopy (HREM) and analytical electron microscopy.



The main thrust of the book is to explain as clearly as possible the basic physical principles underlying transmission electron microscopy in all its various forms. In this Professor *Reimer* succeeds admirably. Although the book adopts a theoretical approach it is also full of useful practical advice. For example on p. 458 we are advised that 'Vacuum leaks can never be cured by heavy greasing but only by carefully polishing the sealing surfaces. Viton rings should be used in preference to rubber. All surfaces should be washed with methyl alcohol, which evaporates completely in air. Finger-marks should be avoided by wearing gloves'. This quotation also illustrates the easy-to-read crisp sentences that the author adopts.

The value of this book lies in its breadth, depth and accuracy. I have indicated its breadth above, but the book also digs deep into the fundamentals of the subject: for example there is a particularly clear exposition of the dynamical theory of electron diffraction, and of applications ranging from the critical voltage effect to the imaging of surface steps.