ADVANCED MATERIALS

Book and Video Reviews

Nonlinear Optics, Lasers, Surface Analysis, NMR, etc. ...

Organic Materials for Non-linear Optics. Edited by *R. A. Hann* and *D. Bloor*. Royal Society of Chemistry, London 1989. xiv, 423 pp., bound, £ 45.00. – ISBN 0-85186-806-1

This book consists of the proceedings of the conference "Organic Materials for Non-linear Optics 1988" held at Oxford University in June 1988, and contains the manuscripts to the plenary lectures, short talks and posters presented at this meeting. The breadth of material covered here corresponds to the generality of the title and includes contributions over almost all current general themes in organic nonlinear optics research.

The first section of this volume deals primarily with theoretical calculations of molecular nonlinearities. The plenary contributions from *Hurst, Munn, Morley* and *Pugh* point out the significant progress made in calculating second order nonlinearities. Other contributions, e.g. from *Garito* et al., indicate that progress has been made in understanding the microscopic basis of third order effects, but that our understanding is still full of gaps and uncertainties, as is our understanding of the correlation between molecular structure and crystal packing, as pointed out in the section on crystals by *Gavezzotti*.

The short section on materials characterization contains a discussion by *Meredith* of the pros and cons of various methods of characterization of NLO materials, as well as an interesting discussion of an application of parametric effects in fast infrared detection by *Hierle* et al.

The next section of the book contains numerous contributions on small organic molecules, as crystals, in solution, or in films, where "small" is taken to include oligomers as well. Here, there is a balance of detailed characterizations of previously reported compounds (*Bailey* et al. and *Bosshard* et al.) and reports of novel structures for both second and third order effects (e.g. *Blanchard-Desce* et al., *Davis* et al., but not limited to these). This aspect is continued in the subsequent short section on organometallics, which have up to now received probably too little attention.

The section on polymeric materials covers several aspects and types of effects in nonlinear optical polymers, from an overview of materials and possible devices (e.g. *Ulrich* and *Möhlmann*) to ultrafast third-order processes (*Prasad*), with contributions as well on synthesis, liquid crystalline polymers and gels. The next section on materials deals with Langmuir-Blodgett films and monolayers at the air-water interface. Among the plenary lectures, *Peterson* summarizes the use of LB films as media for characterization and the requirements for an eventual use of such films in all-optical or electro-optic devices. *Shen*'s contribution summarizes the utility of nonlinear optical methods to study interfacial phenomena in situ. Further short contributions deal with such subjects as polymer amphiphilics, orientation and deposition methods.

An eventual application of organic materials in nonlinear optics depends to a large extent on the ability to construct working devices out of them and integrate them into other systems. The contribution from *Stegeman* reviews proof-of-principle all optical $\chi^{(3)}$ based devices, e.g. interferometers and directional couplers, but offers as well the sobering observation that we are several orders of magnitude away from substances which would lead to practical devices. The contribution from *Lytel* et al. shows on the other hand that we are much closer to commercial integrated optic devices on the basis of $\chi^{(2)}$ polymeric substances, demonstrating that high speed electro-optic modulation in waveguides has already been achieved.

There is quite a bit of information on numerous subjects in this volume. With the plenary lectures, one often has the feeling that one has seen a good deal of it before, but such talks are usually intended to be overviews. The newer information is concentrated in the short poster contributions, which were however too numerous to mention individually here, and it is in these contributions that one is more likely to find results that have not yet been published elsewhere. A critical discussion of both the merits and disadvantages of organic materials in view of advances in inorganic materials would have been welcome, but this was perhaps more the responsibility of the participants than of the editors.

"Organic Materials for Non-linear Optics" summarizes the state of the art in organics for NLO, with a European emphasis, and contains contributions from many of the leading researchers in many aspects of the field. Thus the book can be useful to the researcher trying to attain or maintain an overview of the wide field of organic materials for nonlinear optics. For more detailed information one can always refer to further work from the numerous authors represented in the book.

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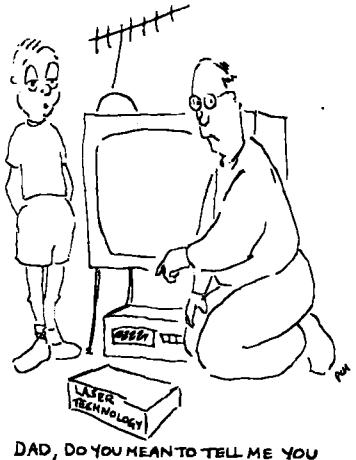
Lasertechnik. Grundlagen, Eigenschaften, Anwendung. VDI-Verlag, Düsseldorf 1989. DM 68. – ISBN 3-18-400879-0 (German language video cassette, 17 min.)

'Laser Technology' a la video show—Much too often we come home with a briefcase loaded with 'things to do' for the

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