Crystal Structure Analysis for Chemists and Biologists J. P. Glusker, M. Lewis and M. Rossi, VCH Publications Inc, New York. 1994. pp. XVII + 854. Price: £ 48.00.

Structural analysis by X-ray diffraction has provided vast amounts of structural information that is of much importance to material scientists, chemists and biologists. Several good textbooks have appeared from time to time on the theory and practice of X-ray structure analysis. However, the recent book on the subject by Glusker, Lewis and Rossi has a distinctly different approach and is a valuable addition to existing books on the subject. This book is primarily addressed to chemists and biologists who might not carry out structure analysis themselves but find that it is essential to understand structural results for planning their own experimental work. The book needs to be reviewed in this light.

The book has been written with great clarity and no previous knowledge of crystallography is required to follow the presentation. However, the book is over 800 pages and perhaps is too long to be suitable for self-study by a large section of non-experts. It is unlikely that individual chapters are understandable without some understanding of earlier chapters. The book might not be useful as a quick reference material unless the interested investigator has spent considerable time on the book. However, it can serve excellently as a textbook for a one-semester course on crystallography for chemists and biologists. After completing such a course, chemists and biologists can benefit from the book which then will serve as a good reference material.

The introductory chapters of the book provide a delightful account of the historical development of crystallography. The nature of crystalline materials, concepts of symmetry, methods for crystal growth, the nature of X-ray diffraction by crystals and how to determine and refine crystal structures are covered without resorting to detailed derivations of relevant equations. These aspects of crystallographic research are presented in small and systematic steps. Good graphical illustrations help non-experts to appreciate crystallographic problems and their solutions. Each chapter presents main concepts introduced for the first time and a glossary of terms newly encountered in the chapter. This will help students to test their comprehension and thus compensates to an extent the lack of questions and problems at the end of each chapter.

X-ray structure analysis provides information on the positions and thermal motions of atoms constituting the crystal. A variety of methods are used by crystallographers to describe, document and analyse these results. Bond lengths, angles and torsion angles are computed from the coordinates obtained by crystallographic refinement. Further analysis provides information on molecular conformation, thermal motion, structural homology between different molecules and structure–function relationships. All of these deduced parameters have errors that result from errors in intensity measurement and other factors such as crystal absorption and radiation damage during data collection. Appreciation of these factors is essential for critical evaluation of structural results. These aspects of analysis of structures are covered in detail in several chapters that follow those dealing with theory and practice of crystallography. In presenting the methods of analysing the final structure, bonding and conformation, the present volume is superior to the excellent book by Stout and Jensen, which has been used extensively as a practical guide (*X-ray Structure Determination, A Practical Guide*, Macmillan, New York, 1968).

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Energy Environment Monitor, Special Issue on Wind Energy. Tata Energy Research Institute, 7, Jor Bagh, New Delhi 110 003. March 1995. pp. 147. Special Issue Price: Rs 200.

This special issue is very comprehensive and educative. What strikes a person who has been following the progress of various renewable energy sources, is that it marks a complete turn around in the technology and approach to wind energy. In the early eighties, wind energy meant old Dutch type windmills and 'appropriate technology'. My experience of these was that not only were they expensive, but never really in real-life use.

The entry in India, of private investment in wind energy proves, if the installed capacity (3600 MW all over the world, 350 MW, India) figure is not enough, that the technology has come of age. The other point that strikes is that among the new renewable energy sources, biogas was the only one that was in actual use all over the country, even if on a small scale. If we assume that the average biogas plant produces the equivalent of 1 kg of kerosene/day, (about 2–3 cum of gas) and that there are one million plants in the country, then the biogas capacity is about 500 MW. Thus, the wind energy has reached the same order of magnitude of production as biogas, which has been around about 50 years, waiting for a breakthrough.

The remnants of the old wind mill are still to be found and are surveyed in the paper by Srinivas *et al.* under case studies (geared type deepwell pumps). Twenty two pumps were surveyed, of which only 8 were functional. The use of the sourced water was for irrigation to a small extent . . . for construction activities, maintaining a lawn etc. The faults were rotor wobbling, falling down, and breaking the tower, etc. The authors recommend publicity along with technical improvements – but I feel publicity should wait until this type of wind mill proves itself in real life use. The authors note that the discharge rates of the functioning wind mills was insufficient for any meaningful irrigation.

The new era in wind energy in India starts with a program of setting up wind monitoring stations in 12 states of the country; 175 such stations have been set up. Though normally wind speeds in middle and the higher latitudes are greater than in tropical areas. India is fortunate in the presence of the monsoon winds. But what is puzzling is that most of our windpower seems to be in the peninsular part and not in the higher latitudes. (Effect of Himalayas?) Based on this, the total potential uncovered so far, is 1,11,854 MW. This is a sizable chunk of our total needs. But what appears as an ideal 'pollution-free energy source turns out to have its own problems and it will not

be surprising if when implemented, some 'activists' will find a cause for agitation. The problems in this regard are noise, particularly the swishing sound from the blades. The other is the bird menace or more correctly, the menace to the birds. The other problem is the unavailability of the land during the construction phase of the windfarm to the owner, 99% being given back after the construction phase, A 20 MW windfarm needs about 5 ha of land. There is a restriction – the land can be used for agriculture or pasture but not for plantations of trees. But generally the wind farms may be located in desert areas or mountain ridges.

Wind power as now growing is mainly as a feeder into an electric power grid, and not as a stand-alone unit, except as a small set-up for battery charging. If we want electricity for remote areas, (a cheaper alternate for photovoltaic systems?) then a hybrid system using wind power and diesel engines with battery storage systems have proven reliable in Australia. But even our not-so-remote rural areas have problems of diesel and kerosene distribution, so I do not consider these as being of much significance in the near future. If a hybrid system based on biomass gasification and wind could be developed, it may supplement each other better. The battery costs may still be prohibitive.

The wind power as already indicated has to feed into a power grid. The studies indicate that 25% is perhaps the limit for the wind power contribution to this grid, based on the uneven production characteristics of wind energy.

A site to be selected for wind farm should have an average of more than 20 kmph for the year. The capital costs are currently very high, about Rs 3.5–4 crores/MW; hydroelectric being the cheapest around 1.5 crores.

The government has thrown open the wind sector to private enterprise, with several fiscal incentives. But like Rajsekhar says in his article on 'Wind energy in India: an overall perspective', the fiscal incentives are related to investment and not performance. Consequently, many wind power plants seem to be designed on a calculator to capture more tax deductions, than wind.

The special issue has a lot of other information in the appendices such as status reports on various states (Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat) – wind farms already installed, in the process of installation, sanctioned, list of manufacturers, etc. There is also a select bibliography and even a calendar of events, which of course would not be of much use now.

All in all, I feel TERI has done well in producing this special issue for those who are interested in renewable energy in general and would like to be brought up-to-date in regard to the wind energy.

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