

have had the knowledge. Kramish speculates that Rosbaud had the opportunity to visit Oslo in November 1939; but he has to admit that although Rosbaud was there in September, Rosbaud himself stated after the war that he had no further contact with Hassel until December. So Kramish has to add to the conjectures with which the book is peppered the further one that Rosbaud's memory was at fault.

As for the speculation that Hassel handed the Report into the Legation, Kramish appears to have overlooked the positive statement by the officer who received it, the Naval Attaché, Captain Boyes, that it came in the form of letters "posted in Norway". That statement was available to Kramish, although he does not mention it. Had he done so, he might have proposed

that Captain Boyes's memory, like Rosbaud's, was at fault.

Actually there is no need for either speculation, for Rosbaud did not write the Oslo Report: to my positive knowledge he had nothing to do either with its provenance or its transmission. At the same time, despite this substantial error, Kramish has performed a welcome service in ensuring a wider appreciation of those genuine and important contributions that Rosbaud so courageously made. □

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Brief encounters

Jeremy K. Burdett

New Directions in Solid State Chemistry. By C.N.R. Rao and J. Gopalakrishnan. Cambridge University Press: 1986. Pp. 516. £55, \$79.50.

SOLID state chemistry is a tough subject and for many years was rather unfashionable. Synthetic techniques are at the Neanderthal stage compared to those used in organic synthesis. Characterization of the reaction product is invariably difficult, because it is often non-crystalline — in these cases, X-ray crystallography, a major tool for the molecular inorganic and organometallic chemist, is inapplicable, and NMR, a mainstay of molecular organic chemistry, is neither as easy to perform nor as easy to interpret. The materials themselves are frequently non-stoichiometric and often the presence of a tiny amount of impurity can dramatically change the crystal structure. In addition, the description of solid state structures, relating the collection of x , y , z coordinates to some geometrical model in terms of linkages between atoms in close contact, sometimes presents quite a challenge. All of these points emerge from a close reading of Rao and Gopalakrishnan's new book, in which the authors attempt to paint a broad picture of our current knowledge of solid state chemistry. At the moment, the field is experiencing a resurgence of interest from chemists of all persuasions, and the appearance of a work of this type is clearly timely.

New Directions, however, is written as a very long review article. It has the flavour of a Chemical Society *Specialist Periodic Report*, in that a large number of topics are covered in each chapter, many of which are described in a sentence or two and then labelled with a reference. The result is that the book provides only a

sketchy overview of the area as a whole, and gives little new insight into some of the tantalizing problems mentioned above.

A further problem for those working on the solid state is how to model the structure of a particular solid in terms of chemical bonds. Chemists have always leaned heavily on structure/bonding relationships, but when it comes to solids, description of the way some of these complex materials hold together is not at all simple. Rao and Gopalakrishnan use the traditional division into solids of different chemical bonding type, and although the shortcomings of the ionic model for coordination number prediction (Pauling's radius ratio rule) are presented, no incisive discussion of this fundamental topic follows. Similarly, although the solid state analogue of molecular orbital theory (tight-binding theory) is mentioned, the pedagogical opportunity presented by this correspondence is not pursued.

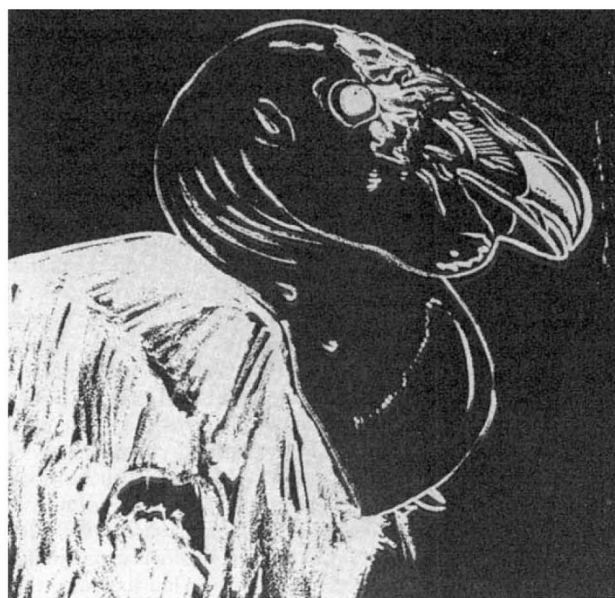
Although it is entitled *New Directions*,

the book is somewhat backward looking. Much of the material describes recent work using traditional concepts and philosophy. For example, studies of the organic solid state in research on conducting polymers have led to some remarkable collaborations between physicists and chemists, perhaps one of the success stories in this interdisciplinary area. A startling variety of species of semiconducting, superconducting and metallic solids have been produced, the properties of which may often be subtly adjusted by changing pressure or the nature of an apparently innocent atom or grouping in the organic building blocks. Polyacetylene and (SN)_x are now textbook examples of these types of materials, and yet less than 12 lines are used to describe them and the science behind them.

Another area which does not get its due is the electronic structure of solids. Large strides have been made in recent years in understanding the crystal structures of extended arrays, but only passing reference is made to the work of the new breed of physicists, chemists and chemical physicists who are intent on linking structure and properties of materials. For example, it has been possible for at least half-a-dozen years to predict by calculation from a list of possibilities the lowest energy structural alternative (admittedly, for simple systems only).

Altogether, the book would serve quite well as a relatively brief introduction to those new to solid state chemistry. But the authors have missed the opportunity to present some of the novel developments of the past few years and convey the excitement which is now percolating through this area. □

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Detail from a painting by Andy Warhol of the California condor; the original is in yellow and red on black. The picture is reproduced from Vanishing Animals, an account in words (by Kurt Benirschke) and pictures (by Mr Warhol) of the plight of 15 species of endangered animal. Publisher is Springer-Verlag, price is DM 120, \$49.50.