

expected. With  $a \approx 10 \text{ \AA}^2$  the quantity  $\langle \omega_M (\Delta F)^2 \rangle$  is approximately equal in different ranges of  $s$ , and the resulting atomic parameters are about halfway between the low-order values and those of refinement G2 (all reflections out to  $s = 1.15 \text{ \AA}^{-1}$ ). No further improvement can be obtained by additional sharpening.

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### Book Reviews

*Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.*

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**Intercalation chemistry.** Edited by M. S. WHITTINGHAM & A. J. JACOBSON. Pp. xvi + 595. London: Academic Press, 1982. Price £57.00, US\$ 87.50.

In this book, all of the chapters are independent except for the first, written by one of the Editors, which gives an introduction to intercalation phenomena. The reader can therefore study at his choice. Because intercalation chemistry is growing significantly and extending into many scientific disciplines, the Editors decided to draw together into this volume related areas in which the host lattice maintains its essential structural features during host-guest reaction – as can be seen from the contents. The book aims to introduce specialist readers to the breadth of intercalation chemistry, and also to acquaint newcomers with the diverse research opportunities and challenges that there are in synthetic and reaction chemistry. Thus, the experimental details and theoretical background are not given. However, the reader can refer to original papers listed at the end of each contribution, and cited almost up to 1980. The book includes a subject index.

Each contribution describes the objective of its field. Many contributors recognize that work on intercalation has been deficient in regard to determination of the structure of the reaction products. However, crystallographic-shear structures, which are not usually considered as related to intercalation compounds, have important similarities in their structures, imposing constraints on the reactions that take place; and these are being studied by determining their structures (ch. 15). Some of the intercalates are now being studied crystallographically (ch. 3). Discussion of intercalation in the context of biological systems indicates an intercalation model compound (ch. 14).

Although the phenomenon of intercalation was first observed in the nineteenth century, detailed studies began

only in the past two decades, and practical applications, and explanations of external appearances, preceded chemical investigations. This volume might stimulate wider interactions, not only among researchers in intercalation chemistry itself but among those in the various materials-science disciplines.

In this connection, a question arises in the mind of the reviewer. Why should a lengthening of the axis perpendicular to the host layer be an indicator of the occurrence of intercalation? In many cases, it is not at all clear what factors decide the length and direction of the axis perpendicular to the host layers in the intercalates, even if the host crystals were set in the appropriate orientation before the host-guest reaction. In practice, the lengthening of the crystal lattice is always detected by an X-ray powder pattern, from which, however, we can only know that the periodicity of the compound changes from one dimension to another; and this cannot mean that the periodic axis is retained. X-ray powder diffraction patterns in which faint peaks are hidden in the background could often be indexed with somewhat longer cell dimensions. Thus, it should be confirmed *by another technique* whether the host layered lattice is maintained or not. This point should be connected with the fact that the bonds between the host and guest molecules are not clearly understood, except in simple ionic cases. (This is a natural consequence of the fact that the structures of intercalated compounds are still scarcely known.) To solve these questions much effort is needed to seek further detailed knowledge.

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