

## Book reviews

### ***Polymorphism in Pharmaceutical Solids***

ISBN: 0-8247-00237-9, New York, 1999, 427 pp.

This book is ‘an attempt to summarize the major issues pertaining to the pharmaceutical aspects of polymorphism, as well as the effects of solvate formation’. The list of contributors is a ‘Who’s Who’ of the leading figures in the field of solid state properties of pharmaceuticals in the USA so the reader would expect this book to be a sound and informative work.

The opening Chapter is an erudite description of the theory and origin of polymorphism written by David Grant. This provides a good theoretical background as would be expected from such a distinguished scientist. Chapter 2 has the title ‘The application of the phase rule to the crystallization of polymorphic systems’, this is a curious extension to the theoretical background, which may well have been better merged with Chapter 1.

The third Chapter, by the editor and Steve Byrn is a well constructed text describing structural aspects of polymorphism, in terms of lattice theory and packing. This is followed by a description of hydrate structure, written by Ken Morris. The description of hydrates is thorough and will be valuable to the readers of this text.

Chapter 5 has the title ‘Generation of Polymorphs, Hydrates, Solvates and Amorphous Solids’ and is written by Keith Guillory. The regulatory issue of testing whether other physical forms exist is addressed here, once again this section is of practical use. The passing discussion of the amorphous form in this Chapter is out of keeping with much of the other text, which, in a deliberately blinkered fashion, deals only with the crystalline state. Methods by which polymorphs and solvates may be characterized are covered in Chapter 6. There is a clear description of X-ray diffraction, microscopy, scanning calorimetry as well as IR, Raman and NMR spectroscopies. Inevitably, the review of methods has to be brief and generalized, as clearly it would be possible to write major works on how to use each of these individual methods. It follows that the book serves to point the way to the techniques which are of use, rather than being an experimental manual.

Chapter 7 is a description of how polymorphism effects solubility and dissolution rate. There is a statement that any solid can only have one true equilibrium solubility in any selected solvent at a defined temperature, however, inexperienced readers could be confused by the text where ‘differ-

ent solubilities’ are mentioned repeatedly. Other than this concern the Chapter is useful and includes a good description of solution calorimetry.

In Chapters 8 and 10 the effect of processing on polymorphism is discussed. Chapter 8 gives examples of bulk storage, milling, granulation, drying and compression and how these conditions may result in changes in crystal form. Inevitably there is some discussion of the amorphous state, which, once again, rests uneasily in the text. My major concern with the book would have to be that the amorphous state should either have been deliberately excluded (if that were possible) or given serious attention. The second option would have been better. The limitation of discussing only the crystallization/crystal state makes Chapter 10 especially difficult, how is an author to discuss freeze dried products in this context? Mike Pikal covers the problems of crystallization and collapse, mannitol crystallization leading to vial breakage and the stability problems associated with crystallization. Chapter 10 is interesting, but because it is essentially about amorphous products, it does not fit in well with the rest of the book.

Chapter 9 is an interesting account of issues which arise from enantiomer and racemate crystal structures.

I imagine one question is whether it is wise to concentrate exclusively on pharmaceuticals in a book such as this. Certainly the food industry has the same issues to cope with and cross fertilization of knowledge between the industries would be beneficial. On balance though, for a text aimed at this introductory level, I think it is wise to use examples with which the reader will be familiar.

Overall the book is a distillation of the wisdom of many experts, written in a manner which should be readily accessible to the complete novice. As this field of solid state properties is of growing commercial interest I would recommend this as a suitable text with which one could get a valuable knowledge base.

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