

# Book Review

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**Hybrid Materials: Synthesis, Characterization, and Applications**

Wiley-VCH, 2006

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The diverse and tuneable functionality achieved through the simultaneous use of inorganic and organic components to produce hybrid materials with enhanced characteristics has resulted in substantial research efforts into the synthesis, characterisation and applications of these materials. In particular, applications in the areas of nanocomposite structural materials consisting of inorganic filler particles, such as clay platelets, within a polymer matrix, nanoporous framework materials for hydrogen storage and zeolite-type materials for catalysis have attracted much attention, both from industry and academia.

As with all texts in the distinctive "blue and white" Wiley-VCH range, the book is finished to a high standard and makes a useful addition to the bookshelf of students and researchers with interests in materials, polymer, inorganic or physical chemistry. My only criticism is that the generally high quality of the book is let down by the presence of a few rather poor resolution schematics, notably in Chapters 6 and 11. The material is nicely organised, covering a diverse range of applications including nanoparticles and nanocomposites, porous materials, biomaterials, coatings, electronics and optics.

The opening chapter provides an excellent introduction to the subject area and even if the casual reader just works through this one, and one or two other chapters of interest, they will find the book highly informative. Basic concepts and terms are clearly described with the aid of useful schematics, tables and images. Synthesis methods and characterisation techniques are described, and applications hinted at, setting the scene for the remainder of the text, which is more applications focussed.

Chapter 2 deals with the subject of nanocomposites of polymers and inorganic particles. It is very nice to see a sub-section on "Consequences of very small particle sizes" as all too often this is missed out. Chapter 3 addresses the preparation of hybrid particles, rather than more macroscopic materials. In Chapter 4 the text returns to composite materials, but now

focussed on clay and other intercalation compounds. Here, layered double hydroxide-polymer and graphite-polymer systems are also addressed, which often are neglected in favour of the more widely researched cationic clays. Inevitably there is some overlap between Chapters 2, 3 and 4, however this is minimal and does not detract from the reading.

In Chapter 5 we move from 2-dimensional materials to 3-dimensional, examining microporous zeolite-type materials, mesoporous structures and metal-organic framework materials. Chapter 6 follows on to cover sol-gel processing of polysilsesquioxane based hybrids. Again, in both these chapters, synthesis, structure and applications are given attention.

The following chapter deals with natural and artificial biomaterials, an important area of hybrid material chemistry. Building blocks are introduced, accompanied by an introduction to the topical area of nucleation and growth in biomineralisation processes. The final four chapters of the text are application focussed, covering medical, optical, electronic/electrochemical and packaging applications, in that order.

In summary, this book manages to be both informative and readable, covering historical aspects through to the state-of-the-art in synthesis, and the actual and potential applications of organic-inorganic hybrid materials. The applied nature of many of the chapters means that the book will be equally of interest to the researcher based in industry, as well as those in academia. The text is broad in scope, with the only notable absence being any chapters on computational chemistry methods, which have become an increasingly useful adjunct to other characterisation techniques for gaining insight into the structure and properties of complex hybrid materials. Though the diverse range of material covered may lead to there being redundant chapters for the specialist, the book is indeed, as described on the cover, "a perfect introduction for the scientist starting in the field" and makes an excellent recommended text for advanced level undergraduate or graduate student courses.

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