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# Book Review

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**Synthesis of inorganic materials**

Wiley-VCH, 2004, 2nd edn, revised and updated,
429 pp; price £45.00/€67.50
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As a chemist with interests encompassing molecular and condensed solid synthesis, I have occasionally been accused of being a 'pot boiler' or using 'shake and bake' methods by solid-state and molecular synthetic colleagues respectively. Of course these somewhat derogatory epithets do not fully represent the diversity of techniques that are now available to today's inorganic chemist. For the preparation of materials in particular, the development of extremely varied synthetic methods reflects the importance not only of composition and structure, but also homogeneity, morphology, defects, surface structure and particle size distribution. It is therefore very important that scientists with an interest in materials have at the very least an appreciation of synthesis and are aware of potential opportunities for materials discovery.

As the authors outline in their foreword, in most textbooks materials are usually classed using criteria such as composition, structure, property or application. Rarely are details and important nuances of a synthetic method provided. The *Synthesis of Inorganic Materials* aims to redress this imbalance, taking examples from major classes of technologically important and academically prominent materials. This is the second, revised and updated edition following the first edition published in 2000.

After a brief introductory Chapter 1, which places the book in context, the main content comprises six chapters, each with reference to further reading followed by a final glossary and comprehensive index. Each chapter is essentially characterized by either a general synthetic method (solid-state reactions, solids from the gas phase, and solids from solutions and melts) or synthetic methods applicable to a particular group of materials (inorganic polymers, porous and nanostructured materials).

Chapter 2 describes reactions where at least one component is in the solid state. These encompass traditional ceramic routes, carbothermal reduction, gas–solid reactions and intercalation. In addition to specific examples, mechanistic aspects of all reaction types are described and fundamental concepts including ion diffusion and nucleation are introduced. Chapter 3 concerns materials prepared using gaseous precursors or via gaseous intermediates. After a brief description of vapor transport methods the majority of the chapter is dedicated to chemical vapor deposition and aerosol processes. A selection of examples has been chosen to represent the major processes that can occur in the gas phase and at the gas–substrate interface. Materials include metals, metal oxides and nitrides, semiconductors and diamond. All common techniques are included and typical synthetic apparatus described. Chapter 4 is the longest chapter dealing with the synthesis of solids from melts and solution. Glass, precipitation, biomineralization, solvothermal and sol–gel processes are all supplemented with ample examples and some limited mathematical treatment is included where necessary. Underlying chemical principles and the relative importance of reaction parameters are emphasized. Chapter 5 describes classes of industrially important inorganic polymers polysiloxane, polysilanes and polyphosphazenes, before briefly touching on transition metal-containing polymers. Current and potential applications are also included. Chapter 6 contains synthetic and processing methodology to introduce porosity into materials ranging from amorphous to crystalline. Metallic foams, aerogels, zeolites, meso- and macroporous materials, and metal organic frameworks are discussed. Chapter 7 focuses on nanostructured materials concentrating on ceramics, semiconductors, metals and nanotubes, including a description of the relevant property or phenomenon that exhibits size dependence.

Each section is written in a very accessible style and placed in an appropriate context, such as property or application, which allows the reader to rapidly grasp the motivation for synthetic development and allows him or her to browse individual sections. The book is well organized and cross-referenced throughout, drawing together the links across chapters, for example between solution synthesis described in Chapter 4 and porosity in Chapter 6. Photographs, diagrams and tables are clear and informative.

The *Synthesis of Inorganic Materials* clearly fills a gap in the market. Many classes of material will undoubtedly benefit from developments in synthetic methodology and stimulation by techniques applied from other fields. It is important that an accessible textbook is available to workers across the extremely disparate field of inorganic materials to not only provide basic information for new students but perhaps also inspire more experienced scientists. I will certainly recommend this book to anyone with a broad interest in synthetic chemistry and materials related science in particular.

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