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Book review

CVD of Nonmetals, ed. W.S. Rees; pp. xvii + 424, with 149 figures and 46 tables; Wiley-VCH, Weinheim & New York, 1996. Price: UK£ 95.00. ISBN 3-527-29295-0

This is the third volume of an ambitious and impressive trilogy devoted to Chemical Vapo(u)r Deposition (CVD). This project was conceived by Dr Peter Gregory of VCH (now merged with Wiley), and the other two volumes entitled 'The Chemistry of Metal CVD' (ed. T. Kodas & M. Hampden-Smith) and 'The CVD of Semiconductors' (ed. A.C. Jones & P. O'Brien) are already available.

Following its development over the last 30 years or so, CVD has emerged as an extremely powerful and versatile technique for the production of thin films of many elements and compounds. These films offer conformal coverage, and in some cases are epitaxial; their wide range of applications include electronic devices, protective and decorative coatings, and structural ceramics. Organometallic chemists are playing an increasingly important role in the design, synthesis and exploitation of CVD precursors which can lead to the economical and rapid deposition of pure materials under mild conditions; in collaboration with physicists, engineers and material scientists they are using variants of the technique such as plasma- and laser-enhanced deposition and are providing insights into the mechanisms of such processes. The sheer number of publications in the area makes any overview a difficult task—the present volume contains over 1300 references, but this represents a careful selection from a far greater number. As an example, the CVD of silicon nitride is well described here in four pages and some 20 references, but recent volumes of Gmelin devoted to silicon nitride include well over 500 references (many of them patents) related to this topic!

After a wide-ranging introduction which defines and briefly explains the concepts, procedures, technical terms and varied acronyms associated with CVD, there follow chapters dealing with superconducting materials (114 pages, mostly concerned with mixed oxides such as $YBa_2Cu_3O_{7-\delta}$), conducting materials (41 pages, focusing on titanium nitride and doped indium, tin and zinc oxides), semiconducting materials (67 pages, with the emphasis on III/V and II/VI compounds, while silicon is summarily dealt with in two paragraphs), insulating materials (59 pages, mainly oxides and main group nitrides and sulphides), and structural materials (46 pages, enhancement of fibre-reinforced composites by coating the fibres, e.g. SiC on carbon, or infiltrating a fibrous pre-form to produce a ceramic matrix). The final chapter (37 pages) deals with a wide assortment of compounds which are reported as having been prepared by CVD. These include exotica such as ZrF_4, Sb_2Te_3, and transition metal carbonitrides. Also included, however, are a number of compounds such as TiN, In_2O_3 and ZnO which have already been treated at greater length in previous chapters. The book ends with an extensive glossary of technical terms, a subject and compound index, and lists providing a key to most of the abbreviations used in the text.

It will be seen that the main divisions are made on the basis of electrical conductivity, and this reflects a prime concern with electronic applications of the products; less emphasis is given to large-scale corrosion protection and the decorative effects conferred by CVD. The book excels in describing the precursors which have been used, deposition procedures, and the properties and applications of the resulting thin films; it is less successful in discussing the chemical design of precursors, the mechanisms of CVD processes, and whether the claimed products are pure. Earlier texts by Stringfellow (1989) and by Hitchman and Jensen (1993) can offer help here. The synthesis of precursors is not addressed, probably for space reasons, but fortunately some recent additions to the *Inorganic Syntheses* series (especially vol. 31) provide detailed guidance.

Obviously there is considerable overlap between this volume's chapter on semiconducting materials and the much more extensive coverage in the second volume of the trilogy edited by Jones and O'Brien. Between chapters of the present volume, too, there is noticeable overlap, particularly in the description of reactor configuration and deposition procedures; the editor acknowledges this in his introduction, stating that: "no effort has been made to particularly curtail components of particular chapters". This has some advantage in making each chapter essentially self-contained. A number of minor errors, mainly typographical and often

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susceptible to a spell-check, were noted but are unlikely to mislead the reader.

Despite these muted critical remarks, it must be emphasised that overall this book represents a notable achievement, in that it provides an authoritative overview of CVD procedures apart from metal deposition. It will provide organometallic chemists with a good introduction to the methods and applications of the technique. It will probably also encourage more to write grant proposals to meet the challenge of providing new precursors for applicable materials.

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