

appropriate introductions to history and background as well as extensive references are given in the review papers. Several papers, presumably the contributed ones, focus on new results such as diffusion in amorphous alloys and ordering kinetics. More detailed discussions on these new results have subsequently been published in other scientific journals.

Overall the book represents current work in diffusion in high technology materials. The papers have a uniform high quality, which is not easily achieved in normal conference proceedings. The editors should be congratulated for such an achievement.

The book is paperbound and consists of camera-ready copy of mixed type styles. I would have preferred an arrangement of papers into groups and identification of invited papers. At the current price, \$88.00, the book may not be for everyone, but the broad, in-depth nature of this collection of papers should be a valuable reference for those whose work is related to diffusion in solids. This book should also be helpful to new graduate students since it provides a general overview of this broad field.

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Sol-Gel Technology for Thin Films, Fibers, Preforms, Electronics, and Specialty Shapes

*Edited by Lisa C. Klein
(Noyes Publications, 1988)*

The title accurately indicates the book's content and philosophy: it presents a survey of applications with emphasis on the technology rather than the science. For gel enthusiasts whose managers ask "But what is it good for?", this book provides a score of answers. It is divided into groups of 3-4 chapters on each of the topics; the chapters are generally 20-30 pages long and have references up to early 1986. The strengths of the volume are its breadth and the inclusion of some good review articles. Its weaknesses are those inherent in a collection of articles: uneven quality, omissions, and some redundancy. There is also a shortage of discussion of fundamentals (e.g., mechanisms of reaction, principles of gelation, drying, sintering, crystallization, film deposition); the technical level of the presentation should be quite understandable for a first-year graduate student.

In the first chapter Ian Thomas provides a practical discussion of the relative merits

of chemicals used as precursors in sol-gel processing, and the tricks by which one produces a homogeneous product. The next two chapters have little to do with applications: Steve Garofalini briefly introduces the use of molecular dynamics for simulating chemical reactions, and Mike Weinberg and George Nielson discuss the reported differences in phase transformation behavior between gel-derived and conventional glasses (concluding that melted gels are indistinguishable from melted glasses, but allowing that sintered gels might be different). These are good articles (particularly the latter), but the space might better have been used for background relevant to the following chapters.

The next section consists of three chapters on films. Helmut Dislich surveys the numerous possibilities and provides a catalog of the properties of coatings produced by Schott using gels; unfortunately, he says nothing about principles or processing. Pettit et al. present a solid discussion of the means of controlling the properties of antireflection coatings, including aging of the sol (promoting the growth of fractal oxide clusters whose structure controls the porosity of the deposited film) and etching. Pantano et al. offer an excellent discussion of the preparation, structure, and properties of oxynitride films which can contain up to 40 mole % N.

The following three chapters discuss fiber drawing from sols. Sumio Sakka reviews the effects of the conditions of hydrolysis and choice of precursor on the structure of the inorganic polymer, which determines the drawability of a sol. Harold Sowman describes the commercial process for fabricating alumina borosilicate fibers, which can be woven into cloth and used for applications including filtration or reinforcement. Bill LaCourse's chapter relates the processing of the fiber to its strength; it is somewhat redundant with respect to Sakka's, but does discuss some novel precursors.

Masayuki Yamane provides a very good introduction to the preparation of monolithic gels (usually uncracked pieces with the smallest dimension greater than a few millimeters). He goes through the process step by step and relates the processing to the structure of the gel and to its survivability. Jochen Fricke details the thermal properties of aerogels (made by drying a gel under supercritical conditions), but does not discuss the process, nor the other uses of such gels (e.g., as catalytic substrates and Cherenkov detectors); however, he does give adequate references to those topics. Shyama Mukherjee's chapter on ultra-

pure glasses reduces to some obvious advice—use clean precursors and work in a clean room. Eliezer Rabinovich reviews the fabrication of gels made from particles (usually generated by flame oxidation, e.g., Cab-o-Sil[®], but sometimes made from solution) which can be used to prepare larger pieces than can be made from alkoxides. The discussion is almost entirely limited to work done at AT&T Bell Laboratories. John Blum's chapter on electronic ceramics, which should have been the longest in the book, is only 6 pages with 26 references. Boilot and Colombari present a good review of the preparation and properties of superionic conductors from gels. Sol-gel processing helps by opening new fields of composition, including organically modified oxides, but also creates problems such as cracking and carbon retention. Downs et al. describe, from a process engineer's point of view, the preparation of hollow spheres (typically 10-200 μm diameter) for use as fuel containers in inertial confinement fusion. Finally, Lisa Klein briefly mentions preliminary work on fabrication of "membranes" from gels, but offers no data at all on their performance as membranes.

This book gives a broad survey of existing and potential applications of sol-gel processing, and can be recommended to any applied scientist thinking about getting into the field. It is quite generally true that technology precedes scientific understanding, and that has been true in sol-gel too, but not to the extent that one might infer from this volume. This is not to suggest that the authors are not acquainted with the underlying science (indeed, many of these authors contributed significantly to our present understanding), but that aspect is not the object of this book. The novice is advised to supplement this book with proceedings of topical meetings on gels, including *Better Ceramics Through Chemistry* (MRS), *Ultrastructure Processing* (J. Wiley and Sons), and *International Workshop on Gels* (J. Non-Cryst. Solids). Those already working in the field will probably find this volume most interesting for the discussion of commercial processes and the references to the patent literature. The volume is inexpensively produced (equations and tables are apparently pasted in from the original manuscripts), but the text and photos are generally clear.

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