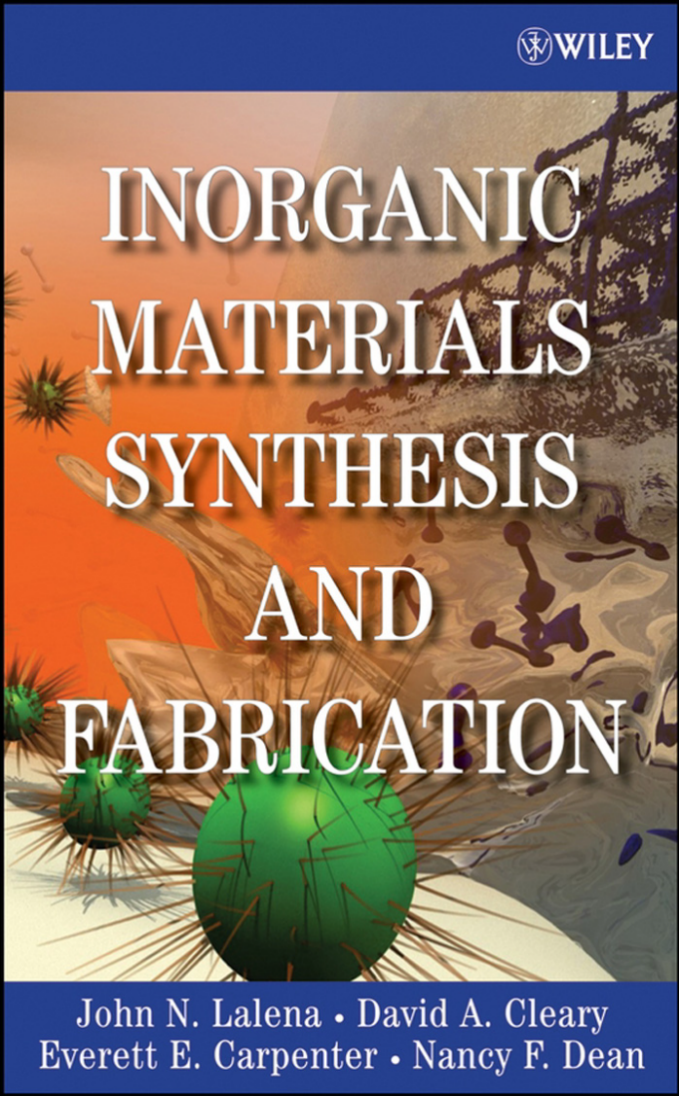

John N. Lalena • David A. Cleary
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CONTENTS

Preface vii

1 Crystallographic and Microstructural Considerations 1

1.1 Relationship Between Physical Properties and Crystallographic Symmetry, 4
1.2 Morphological Crystallography, 9
1.3 Space Lattices, 21
1.4 Surface and Interface Structures, 28
1.5 Controlled Crystal Growth and Microstructural Evolution, 33
1.6 Structures of Glassy and Quasicrystalline Phases, 44
References, 48

2 Chemical Energetics and Atomistics of Reactions and Transformations in Solids 51

2.1 Equilibrium Thermodynamics, 53
2.2 Structural Energetics, 66
2.3 Grain Boundary Energy and Surface Energy Contributions, 73
2.4 Mass Transport and Nonequilibrium Thermodynamics, 83
2.5 Chemical Reaction and Phase Transformation Kinetics in Solids, 86
References, 101

3 Solid–Vapor Reactions 105

3.1 Vapor-Phase Fundamentals, 105
3.2 Vapor Absorption and Adsorption, 109
3.3 Film Formation Basics, 114
3.4 Vapor-Phase Intercalation, 116
3.5 Physical Vapor Deposition, 120
3.6 Chemical Vapor Deposition, 125
3.7 Molecular Beam Epitaxy, 136
References, 138

4 Solid–Liquid Reactions 141

4.1 Solid–Liquid Interface, 141
4.2 Crystallization, Precipitation, and Solidification, 142

4.3 Sol–Gel Processing, 167
4.4 Solvothermal and Hydrothermal Techniques, 171
4.5 Molten Salts and Room-Temperature Ionic Liquids, 173
4.6 Electrochemical Synthesis, 176
References, 179

5 Solid–Solid Reactions **183**

5.1 Solid–Solid Interface, 183
5.2 Ceramic Method, 184
5.3 Mechanical Alloying, 196
5.4 Combustion Synthesis, 199
5.5 Microwave Synthesis, 202
References, 207

6 Nanomaterials Synthesis **211**

6.1 Top-Down Methods for Fabrication of Nanocrystalline Materials, 213
6.2 Bottom-Up Methods for Synthesis of Nanostructured Solids, 216
References, 230

7 Materials Fabrication **233**

7.1 Influence of Structure on Materials Properties, 234
7.2 Deformation and Solidification Methods, 244
7.3 Consolidation Methods, 273
7.4 Summary, 291
References, 291

Appendix A1: General Mechanical Engineering Terms **295**

Appendix A2: Green Materials Synthesis and Processing **297**

Index **299**

PREFACE

With our first textbook, *Principles of Inorganic Materials Design,* we set out to fulfill our stated goal of preparing a single-source presentation of inorganic materials design. Accordingly, the primary emphasis was on structure–property correlation. A comprehensive treatment of the broader general topic of inorganic materials science necessitates that we discuss chemical, synthetic, and fabrication processes, topics we now take up in detail.

Customarily, chemists have been interested in the submicroscopic length scale, studying the compositions and structures of solids, their relationships to properties, and processes that bring about changes in those entities. The physicists who deal with condensed matter have had similar goals working at the electronic length scale, where they have been concerned primarily with describing various physical properties quantitatively. The focus of materials scientists and engineers, on the other hand, has evolved from studying microstructural features and processes to a state in which they now also draw on the body of knowledge acquired by chemists and physicists in order to design improved materials for utilization in specific engineering applications. Today, the artificial demarcation between the various disciplines is beginning to vanish. Becoming consistently common objectives are synthesis and fabrication, which inherently require consideration of details spanning multiple length scales.

To serve the need to educate science and engineering students in this area, in this book we take an interdisciplinary approach, as we did in our first book, but with the focus shifted to describing how chemical reactions proceed between *single-phase* inorganic solids (molecular and nonmolecular) and other substances that result in the transformation of the solid, to a new single phase with composition differing from that of the original material. Such reactions are conveniently categorized here as being of the solid–vapor, solid–liquid, or solid–solid type. In general, synthetic schemes may be thought of as bottom-up processes where the chemical transformation occurs at the interface between the reacting phases.

This book is about the preparation of single-phase inorganic materials. The design concerns and associated process flows for multiphase/heterostructure devices (e.g., composite materials, semiconductor integrated circuits) are better covered in specialized engineering texts and so are omitted here. However, we cover top-down materials fabrication processes, such as plastic deformation and consolidation processing in some detail, topics that have traditionally been restricted to materials science and engineering courses. As with our first textbook, this book takes on a distinct historical tone and includes short biographical sketches of some of the people who have made seminal contributions to the field