

## Foreword

Powder metallurgy and particulate materials processing is abbreviated as P/M<sup>2</sup> and provide the focus for this book. These subjects include a variety of techniques to fabricate engineered products using principles ranging from materials synthesis to industrial engineering. The P/M<sup>2</sup> technologies create particles, control their attributes, consolidate the particles into shapes, and heat the shapes to a temperature where the particles bond into a strong product. Most of the shaping is applied to mass production applications, where the tool cavity is replicated over and over. Accordingly, each piece becomes economical because tooling, engineering, and equipment costs are spread over many parts. Many of the products have unique microstructure and performance attributes leading to a wide diversity of applications.

This book views P/M<sup>2</sup> from a perspective based on the laws of physics, chemistry, mechanics and dynamics, thermodynamics and kinetics, and chemical engineering. It is an outgrowth of the very successful book *Powder Metallurgy Science* (first edition 1984, second edition 1994). Although there is still a heavy emphasis on classic powder metallurgy (ferrous, nonferrous, refractory, cermets, hard materials or cemented carbides), there is now an interwoven treatment of composites, technical ceramics, and related material systems. The intent is to teach the generic principles associated with creating powders and fabricating engineered shapes from those powders; specific chemistries, applications, and engineering details are only used as illustrations. The book is both a text and reference. It is written for engineering students with a background in materials, metallurgy, ceramics, industrial engineering, mechanical engineering, engineering science, and engineered materials. However, it is also sufficiently basic that it can be used for industrial short courses and self-study.

The book is composed of 16 chapters, each composed of many small segments that can be consulted without reading the whole book. Chapter One provides a frame of reference. Chapters Two through Four focus on powder characterization, production, and microstructure control. Chapter Five considers adjustments to a powder for subsequent consolidation. Chapters Six through Eleven are the heart of the P/M<sup>2</sup> process. They focus on shaping, compaction, sintering, hot consolidation, and freeform processes. The balance of the book (Chapters Twelve through Sixteen) goes into finishing operations, characterization of the compact, testing and standards, material properties, designs, applications, and includes information on economics. Appendices are included with definitions, test standards, material properties, and answers to selected study questions. That organization provides both breadth and depth to the subject and sufficient reference information to allow subsequent study by the interested reader.