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German R. M., Powder metallurgy and particulate materials processing, Metal powder industries federation, Princeton, USA, 2005, pp. 522, isbn 0-9762057-1-8, -- Directory of Open Access Journals (DOAJ) Science of Sintering (2006-01-01)

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Powder metallurgy processing of thermal management materials for microelectronic applications RM German, KF Hens, JL Johnson International journal of powder metallurgy (1986) 30 (2), 205-215 , 1994

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RANDALL M. GERMAN is Brush Chair Professor in Materials at the Pennsylvania State University. Formerly Hunt Professor of Materials Engineering at the Rensselaer Polytechnic Institute, he has held a number of industrial, academic, and national laboratory positions.

**Powder Metallurgy Science** is a comprehensive, easy-to-use desk reference, which can be consulted endlessly for quick and authoritative answers - an essential resource for manufacturers, specifiers, end-users and research workers of powdered metals. Metal Powders are being used with increasing frequency in the manufacture of diverse objects, such as watch-cases and piston connecting-rods. Metal properties, techniques for their use and the quality of the objects made are only part of this complex industry which is growing year-on-year. This volume provides a reference source defining terms, explaining processes and illustrating equipment, giving a thorough overview of the industry as a whole. Wwith this book on your desk, you will. 1. Have instant access to definitions, properties and data on powder metallurgy, ensuring you always have accurate information to hand 2. Be able to write with authority for customers and publications 3. Save time, money and effort by researching metal powders properties, processes and the industry as a whole 1. Written by an internationally respected author with many years experience in the field of metal powders 2. An important, easy-to-use reference tool for manufacturers, specifiers, end-users and research workers of powdered metals. 3. Defines terms, explains processes and illustrates equipment, giving a thorough overview of the industry as a whole

A comprehensive guide to current practices Powder metallurgy processes increasingly dominate the production of iron and steel components for a variety of machines, appliances, automobiles, and tools. These processes yield high-quality precision components, recycle scrap metals into useful powders, and consume less energy than traditional manufacturing methods. Despite the tremendous growth in this area, however, until now there has been no guide on practical issues in the field. Powder Metallurgy of Iron and Steel fills the need for a fundamental, nonmathematical treatment of this technology. Focusing on the most useful applications and the advantages of different production techniques, this systematic, self-contained volume provides serious help in tackling production problems on the factory floor. It covers the gamut of practical topics, from injection molding and compaction processes to sintering, full-density processes, heat treatments, finishing operations, and the mechanical properties of many products, including die-compacted steels. Written by a leading authority and designer of educational programs for the industry, Powder Metallurgy of Iron and Steel: Emphasizes current practices and real engineering materials in everyday manufacturing processes Keeps the mathematics simple, boxing the calculations outside the main body of text Includes research articles and trade information from a variety of sources Features numerous pictures and flow diagrams Includes an appendix with an extensive list of definitions This important tutorial for an expanding work force is accessible to scientists and engineers alike, as well as technicians, production supervisors, designers, consultants, and marketing personnel. It is also an excellent textbook for undergraduate and industrial courses.

**Powder Metallurgy Science** is a comprehensive, easy-to-use desk reference, which can be consulted endlessly for quick and authoritative answers - an essential resource for manufacturers, specifiers, end-users and research workers of powdered metals. Metal Powders are being used with increasing frequency in the manufacture of diverse objects, such as watch-cases and piston connecting-rods. Metal properties, techniques for their use and the quality of the objects made are only part of this complex industry which is growing year-on-year. This volume provides a reference source defining terms, explaining processes and illustrating equipment, giving a thorough overview of the industry as a whole. Wwith this book on your desk, you will. 1. Have instant access to definitions, properties and data on powder metallurgy, ensuring you always have accurate information to hand 2. Be able to write with authority for customers and publications 3. Save time, money and effort by researching metal powders properties, processes and the industry as a whole 1. Written by an internationally respected author with many years experience in the field of metal powders 2. An important, easy-to-use reference tool for manufacturers, specifiers, end-users and research workers of powdered metals. 3. Defines terms, explains processes and illustrates equipment, giving a thorough overview of the industry as a whole

Although sintering is an essential process in the manufacture of ceramics and certain metals, as well as several other industrial operations, until now, no single book has treated both the background theory and the practical application of this complex and often delicate procedure. In Sintering Theory and Practice, leading researcher and materials engineer Randall M. German presents a comprehensive treatment of this subject that will be of great use to manufacturers and scientists alike. This practical guide to sintering considers the fact that while the bonding process improves strength and other engineering properties of the compacted material, inappropriate methods of control may lead to cracking, distortion, and other defects. It provides a working knowledge of sintering, and shows how to avoid problems while accounting for variables such as particle size, maximum temperature, time at that temperature, and other problems that may cause changes in processing. The book describes the fundamental atomic events that govern the transformation from particles to solid, covers all forms of the sintering process, and provides a summary of many actual production cycles. Building from the ground up, it begins with definitions and progresses to measurement techniques, easing the transition, especially for students, into advanced topics such as single-phase solid-state sintering, microstructure changes, the complications of mixed particles, and pressure-assisted sintering. German draws on some six thousand references to provide a coherent and lucid treatment of the subject, making scientific principles and practical applications accessible to both students and professionals. In the process, he also points out and avoids the pitfalls found in various competing theories, concepts, and mathematical disputes within the field. A unique opportunity to discover what sintering is all about--both in theory and in practice What is sintering? We see the end product of this thermal process all around us--in manufactured objects from metals, ceramics, polymers, and many compounds. From a vast professional literature, Sintering Theory and Practice emerges as the only comprehensive, systematic, and self-contained volume on the subject. Covering all aspects of sintering as a processing topic, including materials, processes, theories, and the overall state of the art, the book \* Offers numerous examples, illustrations, and tables that detail actual processing cycles, and that stress existing knowledge in the field \* Uses the specifics of various consolidation cycles to illustrate the basics \* Leads the reader from the fundamentals to advanced topics, without getting bogged down in various mathematical disputes over treatments and measurements \* Supports the discussion with critically selected references from thousands of sources \* Examines the sintering behavior of a wide variety of engineered materials--metals, alloys, oxide ceramics, composites, carbides, intermetallics, glasses, and polymers \* Guides the reader through the sintering processes for several important industrial materials and demonstrates how to control these processes effectively and improve present techniques \* Provides a helpful reference for specific information on materials, processing problems, and concepts For practitioners and researchers in ceramics, powder metallurgy, and other areas, and for students and faculty in materials science and engineering, this book provides the know-how and understanding crucial to many industrial operations, offers many ideas for further research, and suggests future applications of this important technology. This book offers an unprecedented opportunity to explore sintering in both practical and theoretical terms, whether at the lab or in real-world applications, and to acquire a broad, yet thorough, understanding of this important technology.

The A-Z of Powder Metallurgy is a comprehensive, easy-to-use desk reference, which can be consulted endlessly for quick and authoritative answers - an essential resource for manufacturers, specifiers, end-users and research workers of powdered metals. Metal Powders are being used with increasing frequency in the manufacture of diverse objects, such as watch-cases and piston connecting-rods. Metal properties, techniques for their use and the quality of the objects made are only part of this complex industry which is growing year-on-year. This volume provides a reference source defining terms, explaining processes and illustrating equipment, giving a thorough overview of the industry as a whole. Wwith this book on your desk, you will. 1. Have instant access to definitions, properties and data on powder metallurgy, ensuring you always have accurate information to hand 2. Be able to write with authority for customers and publications 3. Save time, money and effort by researching metal powders properties, processes and the industry as a whole 1. Written by an internationally respected author with many years experience in the field of metal powders 2. An important, easy-to-use reference tool for manufacturers, specifiers, end-users and research workers of powdered metals. 3. Defines terms, explains processes and illustrates equipment, giving a thorough overview of the industry as a whole

As sintering applications march toward a \$30 billion global business, the models for sintering have progressed, but generally follow behind observation. Documentation of the steps needed to build to a quantitative and predictive theory are often missed. Sintering: From Empirical Observations to Scientific Principles partitions sintering applications and observations to show critical turning points required to establish modern sintering as a predictive science. This book, written by the most cited author in his field, is laced with people, organizations, critical steps, and important formulations in a mixture of history, personalities, and applications. Exploring how insights in seemingly unrelated fields sparked progress, it is also a teaching tool to show where there is success, where there are problems, and how to organize teams to leapfrog to new applications or plateaus of use. Randall German's Sintering: From Empirical Observations to Scientific Principles is a platform for directly addressing the critical control parameters in these new research and development efforts. Shows how the theories and understanding of sintering were developed and improved over time, and how different products were developed, ultimately leading to important knowledge and lessons for solving real sintering problems Covers all the necessary infrastructure of sintering theory and practice, such as atomic theory, surface energy, microstructure, and measurement and observation tools Introduces the history and development of such early sintered products as porcelain, tungsten lamp filaments, bronze bearings, steel automotive components, platinum crucibles and more

Binder and Polymer Assisted Powder Processing is an engineering guide to powder-binder-based manufacturing methods. It covers the basic principles, current and emerging practices, implementation, and cost.

In the past few years there has been rapid growth in the activities involving particulate materials because of recognized advantages in manufacturing. This growth is attributed to several factors; i) an increased concern over energy utilization, ii) a desire to better control microstructure in engineermg materials, iii) the need for 1mproved material economy, iv) societal and economic pressures for higher productivity and quality, v) requirements for unique property combinations for high performance applica tions, and vi) a desire for net shape forming. Accordingly, liquid phase sintering has received increased attention as part of the growth in particulate materials processing. As a consequence, the commercial applications for liquid phase sintering are expanding rapidly. This active and expanding interest is not well served by available texts. For this reason I felt it was appropriate to write this book on liquid phase sintering. The technology of liquid phase sintering IS quite old and has been in use in the ceramics industry for many centuries. However, the general perception among materials and manufacturing engineers is that liquid phase sintering is still a novel technique. I believe the diverse technological appli cations outlined in this book will dispel I such impressions. Liquid phase. sintering has great value in fabricating several unique materials to near net shapes and will continue to expand in applications as the fundamental attrib utes are better appreciated. I am personally involved with several uses for liquid phase sintering.

Titanium Powder Metallurgy contains the most comprehensive and authoritative information for, and understanding of, all key issues of titanium powder metallurgy (Ti PM). It summarizes the past, reviews the present and discusses the future of the science and technology of Ti PM while providing the world titanium community with a unique and comprehensive book covering all important aspects of titanium powder metallurgy, including powder production, powder processing, green shape formation, consolidation, property evaluation, current industrial applications and future developments. It documents the fundamental understanding and technological developments achieved since 1937 and demonstrates why powder metallurgy now offers a cost-effective approach to the near net or net shape fabrication of titanium, titanium alloys and titanium metal matrix composites for a wide variety of industrial applications. Provides a comprehensive and in-depth treatment of the science, technology and industrial practice of titanium powder metallurgy. Each chapter is delivered by the most knowledgeable expert on the topic, half from industry and half from academia, including several pioneers in the field, representing our current knowledge base of Ti PM. Includes a critical review of the current key fundamental and technical issues of Ti PM. Fills a critical knowledge gap in powder metal science and engineering and in the manufacture of titanium metal and alloys

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