# Powder metallurgy fundamentals and sintered materials

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## *Abstract*

***The aim of the book****: The aim of the book is to present general knowledge on powder metallurgy, taking into especial consideration tool materials made with the use of that technology. The book has been written on the basis of literature review and is a result of many-year didactic experiences of both Authors in that field. The motivation to its publication is also an intention to present the selected results of many-year own researches carried out in the Division of Materials Processing Technologies, Management and Computer Techniques in Materials Science of the Institute of Engineering Materials and Biomaterials of the Silesian University of Technology and experience gained during the realisation of numerous domestic and international research projects, e.g. within the cooperation with one of the best European research centres dealing with powder metallurgy – the University of Carlos III in Madrid.*

***The content and scope of the book****: The book begins with the chapter defining the significance of the selection of materials processing technology and the selection of materials in engineering design and generally in manufacturing processes of products and their elements. Powder metallurgy has been especially distinguished among those technologies, defining it and presenting fundamental information concerning that technology. The following chapters of the book present information and results of own research, concerning the improvement of utility properties of sintered tool materials, such as high-speed steels, steel matrix composites reinforced by carbides, cemented carbides, cermets, ceramic and super hard materials as well as both gradient materials investigated within last few years and also made with selective laser sintering methods and new technologies of forming and powder sintering, among others: PIM method (Powder Injection Moulding) and MIM method (Metal Injection Moulding). The last part of the book includes instructions for the realisation of laboratory classes.*

***The scope of laboratory classes****: In that part of the book instructions for laboratory classes realised in the framework of subjects: "Fundamentals of materials science", "Metal materials" and "Ceramic materials" and within specialist classes including several following subjects have been presented. The realisation of the aim of the classes presented in the instruction will enable students to familiarise themselves in details with powder technological properties, classic compaction and sintering technologies, modern methods of injection, non-pressure and extrusion moulding and a unique selective laser sintering methods. Mentioned new technologies and full laboratory equipment being at the disposal of the Institute of Engineering Materials and Biomaterials ensure the high level of realised classes, which will result with rich knowledge and high skills gained by students.*

***Reference to this monograph should be given in the following way:***
*L.A. Dobrzański, G. Matula, Powder metallurgy fundamentals and sintered materials, Open Access Library, Volume 8 (14) (2012) 1-156 (in Polish).*

Fundamentals of metallurgy. Related titles: New developments in advanced welding (ISBN-13: 978-1-85573-970-3; ISBN-10: 1-85573-970-4) Recent developments in high-technology areas have significantly transformed the welding industry.Â  The materials used in automotive engines are required to fulfill a multitude of functions. It is a subtle balance between material properties, essential design and high performance characteristics. The intention here is to describe the metallurgy, surface modification, wear resistance, and chemical composition of these materials.Â  The solid phases undergo undesirable structural changes, such as fusion, sintering, and excessive reduction of internal porosity and surface area, as temperature becomes too high. Baikov Institute of Metallurgy and Materials Science, Russian Aca- demy of Sciences, Moscow, Russia Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences (ISMAN), Chernogolovka, Moscow Region, Russia Russian Federation. orresponding Member of Russian Academy of Sciences, Dr. Sci.Â  2. Alymov M.I. Poroshkovaya metallurgiya nanokristallicheskikh materialov [Powder metallurgy of nanocrystalline materials]. Moscow: Nauka, 2007, 169 p. (In Russ.). 3. Alymov M.I., Shustov V.S., Ustyukhin A.S., Evstratov E.V. Correlation between the quality of nanopowders and productivity rate for fabrication technology of them. Figure 1. Powder metallurgy production routes. Powder Metallurgy and Sintered Materials. 3. requirements (see, e.g., [4]), whereas some properties, especially mechanical properties, can be inferior to those of, e.g., wrought and machined parts. The main benet of PM is economical: For large production runs of preci- sion components, PM is frequently more cost-effective than classical metalworking tech-niques.Â  The classical method of metal powder produc-tion is ore reduction (already performed in the early iron age (â†' Iron, 1. Fundamentals and Principles of Reduction Processes; â†' Iron, 2. Blast Furnace Process; â†' Iron, 4. Smelting Reduction Processes). The starting product is puried iron ore (magnetite, $Fe_3O_4$). The. 8 Powder Metallurgy and Sintered Materials. Figure 10. Powder metallurgy (PM) of biomaterials is still a niche market, but considerable progress in related manufacturing technologies opens up the possibility of participating in the emerging market for medical devices and surgical implants within the next decade. PM technologies like metal injection moulding (MIM) are promising manufacturing routes if large quantities of complex-shaped parts are required. In addition, porous implants or coatings that improve implant fixation by bone ingrowth are preferentially made by PM technologies. In this chapter, the most promising PM routes for biomedical app The book presents the fundamentals and the role of powder metallurgy in contemporary technologies and the state of the art of classical powder metallurgy technologies and a general description of new variants and special and hybrid technologies used in powder metallurgy. The next part includes over a dozen case studies provided in the following chapters, comprehensively describing authors' accomplishments of numerous teams from different countries across the world in advanced research areas relating to powder metallurgy and to special and hybrid technologies.Â  Open access peer-reviewed. 2. Fabrication Technologies of the Sintered Materials Including Materials for Medical and Dental Application.

Material. Powder metallurgy (pm) process technology. Classification. Description.Â  Sintered Steels Surface Densified Sintered Steels PM Aluminium Materials Stainless Steels Powder Forged Steels Bearing Materials (DIN-/ISO-Standard Info) Bearing Materials (US-Standard Info) Sintered Soft Magnetical Materials Soft Magnetic Composits (SMC) MIM - Case Hardened Steels MIM - Corrosion Resistant Steels MIM - Heat Treatable Steels MIM - Soft Magnetic Steels MIM - Alloys for High Temperatur Applications MIM - Tool Steels. Fundamentals of metallurgy. Related titles: New developments in advanced welding (ISBN-13: 978-1-85573-970-3; ISBN-10: 1-85573-970-4) Recent developments in high-technology areas have significantly transformed the welding industry.Â  The materials used in automotive engines are required to fulfill a multitude of functions. It is a subtle balance between material properties, essential design and high performance characteristics. The intention here is to describe the metallurgy, surface modification, wear resistance, and chemical composition of these materials.Â  The solid phases undergo undesirable structural changes, such as fusion, sintering, and excessive reduction of internal porosity and surface area, as temperature becomes too high. Powder metallurgy (PM) of biomaterials is still a niche market, but considerable progress in related manufacturing technologies opens up the possibility of participating in the emerging market for medical devices and surgical implants within the next decade. PM technologies like metal injection moulding (MIM) are promising manufacturing routes if large quantities of complex-shaped parts are required. In addition, porous implants or coatings that improve implant fixation by bone ingrowth are preferentially made by PM technologies. In this chapter, the most promising PM routes for biomedical app In powder metallurgy of superalloys and titanium materials, the commercial success depends upon selection of suitable techniques for powder production as well as for powder processing. View. Show abstract.Â  The Sinter/HIP â€" Process is a technology for sintering and post â€" densification in one cycle with low pressures. It is a beneficial and economical method for the production of dense and homogeneous materials. Sinter/HIP may be a favored technology for polyphase materials, such as cemented carbides, heavy metal alloys or ceramics, which consist at the sintering temperature of hard grains and a highly mobile or viscous phase.