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:
Powder metallurgy (PM) is a term covering a wide range of ways in which materials or components are made from metal powders. PM processes can avoid, or greatly reduce, the need to use metal removal processes, thereby drastically reducing yield losses in manufacture and often resulting in lower costs. Powder metallurgy is also used to make unique materials impossible to get from melting or forming in other ways. A very important product of this type is tungsten carbide (WC). WC is used to cut and form 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 benefit of PM is economical: For large production runs of precision components, PM is frequently more cost-effective than classical metalworking techniques. The classical method of metal powder production is ore reduction (already performed in the early iron age (Â¬Â¬ Iron, 1. Fundamentals and Principles of Reduction Processes; Â¬Â¬ Iron, 2. Blast Furnace Process; Â¬Â¬ Iron, 4. Smelting Reduction Processes). The starting product is purified iron ore (magnetite, Fe3O4). The. 8 Powder Metallurgy and Sintered Materials. Figure 10. Powder steels have been used for knife making for more than 30 years. Over the years, the price of such steel has significantly decreased; they have become more affordable and applicable in a variety of knives, including not only the premium segment. What is the difference between powdered steel and "normal" and how is it made? Powdered steel is steel that is sprayed in an inert gas, then the suspension is fed to a special mold, and then the resulting micro-ingots are pressed at ultra-high temperatures and sintered in a special furnace. As a result of these actions, the so-called pow... Powder metallurgy process can be applied to not only metal materials but also ceramics and organic materials, which both are employed as structural and electrical products. Author contributions to Powder metallurgy present excellent and significantly important research topics to evaluate various properties and performance of P/M materials for applying these materials as actual components. In particular, the life estimation of P/M ferrous materials by sliding contact fatigue test and tribological performance evaluation of P/M semi-metallic materials are focused and introduced in this book. Kats