Structure and properties of composite coatings on sintered carbide and nitride and sialon ceramics

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Abstract

***The aim of the book**: The purpose of this book is to present a general knowledge on PVD and CVD coatings taking into consideration tool materials produced in the technology. The book came into being based on the literature review and as a result of many-year didactic experiences of Authors in that range. The motive to its publication is also a will to present chosen results of many-year own research 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 acquired during the realisation of numerous national and international research projects.*

***The content and scope of the book**: The book is a collection of five of appropriately selected, but separately worked out monothematic papers, including some being literature studies and other being summaries of own scientific research. The book begins with a paper on tool engineering materials with particular emphasis on sintered tool materials. Among technologies powder metallurgy, defining it and presenting basic information on this technology is distinguished. In the next paper the general characteristics of the importance of surface treatment of sintered tool materials is presented. In following papers included in the book information and results of own research concerning the improvement of functional properties of blades made of sintered carbides and nitride and sialon ceramics coated by multicomponent PVD and CVD coatings. The outworking of manufacturing technology and multi-phase gradient coatings using methods of cathodic arc evaporation CAE are presented. Next the study of the structure and properties of coatings deposited to carbide and ceramic tool*

materials having the required properties: high adhesion, microhardness, high wear, corrosion and diffusion resistance in the functional conditions of highly efficient tools used in machining. The complex results of a study on scanning and transmission electron microscopy, the results of mechanical and tribological properties of investigated coatings are presented. Also the study of the chemical composition of produced coatings by the use of a spectrometer of energy of distributed X-ray EDS, the optical spectrometer GDOS of glow discharge and by the use of X-ray diffractometer is described. In order to analyse in details the studies of multi-edge cutting samples, trials of grey cast iron cutting with different technological parameters were carried out.

Reference to the collection of papers included in the book should be given in the following way:

L.A. Dobrzański, D. Pakuła, M. Staszuk, A.D. Dobrzańska-Danikiewicz, Structure and properties of composite coatings on sintered carbide and nitride and sialon ceramics, Open Access Library, Annal V (2015) Issue 1, 1-173 (in Polish).

SiAlONs were developed as a more cost-effective substitute for hot pressed silicon nitride. They should be considered a family of alloys with a broad range of properties.Â In comparison to hot-pressed silicon nitride, the very high temperature-resistance properties of SiAlON materials produced via pressureless sintering are limited by the glassy phases that form at grain boundaries during the sintering process. These materials are only suitable for long term use at temperatures < 1200 Â°C. Typical properties are outlined in Table 1. Table 1. Typical Physical and Mechanical Properties of SiAlON (Syalon 101). Property. Density (g.cm-3). The silicon nitride ceramics with a benecial combination of low dielectric losses and improved physical properties was fabricated by cold isostatic pressing and pressureless sintering. The ne grain microstructure, three-phase composition based on the Î²-SiAlON, the small amount of the glass phase and relatively small porosity promote a unique combination of a low thermal conductivity 14.51 W mâˆ’1 Kâˆ’1 and low dielectric loss 1.4Â·10âˆ’3. A novel method is proposed to overcome the main drawbacks of the commercial and high-cost technologies. 1. Introduction.Â Common sintering additives are mixtures of such metal oxides as aluminum oxide, yttrium oxide and magnesium oxide.Â Fully dense SiAlON was obtained by cold isostatic pressing and free sintering. Fig.