

The Book of Critical Technologies of Surface and Properties Formation of Engineering Materials

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Abstract

Purpose: *The purpose of this book is to establish and harmonise knowledge on the most promising, critical technologies of structure and properties formation of surface layers and coatings of different engineering materials using a developed and verified experimentally, original custom methodology of the computer-integrated prediction of such technologies' development. This methodology employs heuristic research of strategic knowledge management, using the technology e-foresight method, through a multi-stage examination of experts' opinions with the e-Delphix method, together with the preparation of contextual matrices, roadmaps and technology information sheets provided in the book. The newly established methodology also serves to create alternative scenarios of future events connected with the forecast development directions of the analysed technologies, aided by information technology. The information technology applied encompasses virtual organisation, web platform and artificial neural networks, in conjunction with modelling with the Monte Carlo method. The research undertaken is aimed at the dissemination of the knowledge acquired and at facilitating the effective transfer of the analysed technologies to industrial establishments, especially micro-, small- and medium-sized enterprises and at commercialising such knowledge, in particular by developing a custom concept of technology e-transfer.*

Design/methodology/approach: *The book uses a complex methodological apparatus, representing an author's achievement, serving to diagnose the key scientific, technological, economic and ecological issues in the area of engineering materials surface engineering and to identify the directions of its strategic development and related decision-making. New, custom technology e-foresight methods were applied connected with creating an original computer system based on a web platform and virtual organisation, enabling, most of all, to conduct on-line surveys with the e-Delphix method. The computer system also enables to determine alternative scenarios of future events based on the developed, author's SCENNET21 and SCENNET48 software using artificial neural networks. 140 selected priority technologies, out of approx. 500 technologies, were characterised and compared as a result of the detailed works carried out, with such technologies being classified within two thematic fields representing a process and consumer approach.*

Findings: *The underlying scientific, but also applicational accomplishment of this book is that the strategic position of 140 critical technologies of structure and properties formation of engineering materials was selected, characterised and determined in a clear and harmonised manner, and that strategic directions and multi-variant probabilistic scenarios of such technologies' development were set up. The outcomes were summarised of the author works conducted so far with participation of a team of experts composed of nearly 500 persons, with such works carried out in the framework of an organised system of co-operation and acquisition of hidden knowledge possessed by each of the experts and with such knowledge being converted into openly available knowledge. The openly available knowledge can be processed and harmonised in order to establish the development*

forecasts of each of analysed technologies and to set general tendencies and general development trends in the context of the development of domestic economy or even in a global scale. An interdisciplinary, custom methodology of the computer-integrated prediction of the development of materials surface engineering, applied for the performance of heuristic research, the outcomes of which are described in the book, has also its universal value and can be easily applied for any other technological area. This, however, can happen on the condition that appropriately extensive e-foresight research is pursued using the custom e-Delphix method and with participation of a team of several hundred experts selected appropriately. The e-foresight research method of computer-integrated diagnosis and prediction of development of any group of technologies using the e-Delphix method and information technology, encompassing virtual organisation, web platform and artificial neural networks, can be applied as the only method, without a need to pursue costly and time-consuming, classical materials-science research.

Research limitations/implications: The book presents conceptual assumptions of the technology e-transfer idea only, although organisational measures have already been undertaken for its practical implementation, confirming that it is possible, needed and necessary to implement the outcomes of the research performed in the economic reality at a macro-, mezo- and micro-level. It is too early, however, to present the outcomes of such works and for this reason they can be included in subsequent publications.

Practical implications: The knowledge made available in the book, especially as roadmaps and information sheets of 140 critical technologies and surface engineering development scenarios, can be used by entrepreneurs and other business units to employ such knowledge for the business activity conducted. Such knowledge can be used by local authorities and economic self-governments on a local and national level and applied in decision-making processes concerning the allocation of public funds and preparation of development strategies. The use of such knowledge in long term will serve to ensure a high quality of technologies implemented in enterprises and sustainable development and a stronger knowledge- and innovation-based economy, contributing to domestic economy's competitiveness. Surface treatment technologies need to be popularised through effective transfer to industrial plants and through commercialisation, as this issue is significant in economic terms. Moreover, many of the detailed surface treatment technologies and their technological variants are applied or may be applied in products manufactured using all the basic groups of engineering materials.

Originality/value: The book is original for its unconventional methodological approach to solving the research intentions undertaken. This approach, apart from classical analytical methods and tools, consists of original, created contextual matrices, roadmaps and technology information sheets provided in the book together with alternative scenarios of development, created with the aid of neural networks. The crowning of author accomplishments is a newly developed methodological concept of the e-transfer of technology using the state-of-the-art Internet Platform of Technology e-Transfer, holding a database of the priority innovative technologies of surface treatment of modern engineering materials, established in the framework of this scientific book. The long-term effects of the e-foresight research performed, broadly disseminated via the Internet – in line with the technology e-transfer concept – can be considered one of the crucial factors contributing to the accelerated sustainable development of Poland and Europe, a stronger knowledge- and innovation-based economy and statistical growth in the quality of the technologies used in industry.

Keywords Materials surface engineering; Knowledge and information management; Heuristic research; Technology e-foresight; Technology e-transfer; Technology roadmaps; Technology information sheets; Development scenarios

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This book provides the Creep2017 Conference abstracts, provides the actual statement of recent developments in the creep analysis. It will cover the following topics: Creep mechanisms of thermo-physical properties and strain rate behaviour of honeycomb alloys to study the effect of rub in in outer air seals 29 X.M. Wang, X.Z. Wang, Y. Wang, Y.Y. Hou, L. Li, Z.F. Yue The influence of thickness on the creep behavior of the thin-walled cylindrical sample of nickel-based single crystal superalloys. 3 Department of Materials Science and Engineering, Stanford University, Stanford, CA, USA. Email: pharr@tamu.edu. The book consists of abstracts of plenary lectures, oral reports and posters presented at the XXXV International Conference on Equations of State for Matter (16 March 2020, Elbrus, Kabardino-Balkaria, Russia). The presentations deal with the contemporary investigations in the field of physics of extreme states of matter. Petrik G.G. Infection point of the potential curve, potentials companion: Critical parameters forecast . . . Kudryavtseva I.V., Rykov S.V., Sverdlov A.V., Ustyuzhina E.E., Rykov V.A. Method of modeling the line of phase equilibrium of individual substances . . . The formation of nanomaterials by thermoplasmonics laser-induced backside wet etching 166. Purpose: To evaluate the state of art on the relations between surface properties (surface roughness, topography, surface free energy and chemistry) of resin-based composite materials and microbial adhesion and biofilm formation. Methods: An electronic search using Scopus and PubMed (until May 2015) was conducted applying the following search items: "Plaque OR Biofilm AND Surface chemistry", "Plaque OR Biofilm AND Surface-free energy", "Plaque OR Biofilm AND Roughness", "Surface characteristics AND Composites", "Biofilm AND Surface characteristics" This book gives a broad introduction to these properties and limitations. It cannot make you a materials expert, but it can teach you how to make a sensible choice of material, how to avoid the mistakes that have led to embarrassment or tragedy in the past, and where to turn for further, more detailed, help. The group is particularly interested in the effective and innovative use of technology in teaching. They realised the potential of the material for the teaching of Materials Engineering to their students in an online environment and have developed and then used these very popular tutorials for a number of years at UNSW. The results of this work have also been published and presented extensively. Materials science or materials engineering is an interdisciplinary field involving the properties of material (matter) and its applications to various areas of science and engineering . This science investigates the relationship between the composition (including structure of materials at atomic or molecular scales) and their macroscopic properties. It includes elements of physics and chemistry , and the information is applied in chemical , mechanical , civil and electrical engineering .

Materials

Materials science and technology. Edited by Sabar D. Hutagalung. Materials Science and Technology Edited by Sabar D. Hutagalung. Physical properties of materials usually play an important role in the selection of material for a particular application. This involves many factors such as material composition and structure, fracture and stress analysis, conductivity, optical, and thermal properties, to name a few. It also involves design, modeling, simulation, processing, and production methods. The structure of a material of a hot layer, going to a firing surface, shows, that during trials it in main loses components of cement. Zirconat of barium is partial in other zones, is partially decomposed with selection as an independent phase Al_2O_3 . Adhesive wear occurs when a titanium surface contacts with most engineering material surfaces, whether they are metallic or ceramic, under force, in motion. Hence, titanium alloys are particularly prone to adhesive wear, leading to seizure and galling (Rabinowicz, 1954; Miller and Holladay, 1958/59). The strong adhesion tendency of Ti is clearly reflected in the high and unstable coefficient of friction when titanium slides against itself or other engineering materials. The initial decrease of the wear rate with the sliding speed could be attributed to the formation of oxide film because of the flash temperature induced by friction during dry sliding (i.e. oxidation wear).

3.4. Effect of load and sliding speed (Molinari et al., 1997). - to establish physical and technological regularities of pore formation on the surface of semiconductors. 4. Materials and methods for examining the process of control over pore formation on the surface of semiconductors. To study morphological properties of nanostructures, we used a method of scanning electron microscopy. 4. 2. Construction of scheme of control over pore formation of on the surface of semiconductors. When we deal with control over the process of electrochemical pore formation on the surface of semiconductors, we shall consider a general scheme of control over the process of electrochemical dissolution of crystal and its component - "semiconductor - electrolyte". As the system "semiconductor - electrolyte" is exposed to many external factors, it is open. The durability of material depends on its quality. Good quality material is inherently durable. The durability can be increased by proper choice of materials propositioning, placing and curing. Another way of enhancing the durability of concrete is by applying a coating. practical importance in modern technologies, especially in the production of new materials for applications. in electronics, wear and corrosion resistant materials, medical applications, battery technologies [6]. In electroplating a coating is electrodeposited upon an electrode (the part to be coated), which is generally. order to control the formation of oxides on the coated surface, coatings can be done under vacuum. environment.