Editorial

Materials processing technologies and new materials are a key research and developmental range, having a fundamental meaning for industry and other fields of the application of those technologies. To define the detailed programmes of 7th Framework Programme of the European Union in the field of materials and methods of manufacturing the results of researches made in the framework of technological Foresight of Europe in the 5th and the 6th Framework Programme of the European Community and announced in the reports from the realisation of the projects The Future of Manufacturing in Europe (FutMan)[1] and Manufacturing Visions The Futures Project (ManVis)[2] have been used. The generalisation of results of European Foresight for various materials and various materials processing technologies is an expectation for manufacturing of materials having properties ordered by product users. It changes fundamentally the methodology of materials design in general and materials design of products because on the demand of producers it is necessary to deliver materials having suitable structure guaranteeing a required set of physical and chemical properties, and not as in the past, users could choose from delivered materials having offered structure and properties, material being the closest one to their expectations. European prognoses desire then classification of engineering materials taking into consideration functional characteristics. That is why a kind of used materials is less important than its functionality. In the reports of the project FutMan the change in the evaluation of the role of engineering materials, which cannot be still seen as goods themselves and the market of new engineering materials cannot be a producer market any longer. New engineering materials and manufacturing processes are then assigned to a client's needs and product practical functions. Manufacturing of materials on demand is the priority of new materials and manufacturing processing technologies. Numerous activities defined in the European Foresight connected with modelling and simulation of manufacturing processes modelling and simulation and the prediction of materials functional properties, the outworking of safe technologies of materials and products consisting of nanostructural elements, the normalisation of materials properties researches, especially of structural ones, the outworking of methodology of perdition of new materials behaviour during exploitation are connected with such a changed methodology of materials design. In the European technological Foresight complementary fundamental (improvement of existing solutions), alternative (using synergy of various solutions) and original (outworking of new development) technologies are foreseen. The application of achievements of nanoscience and nanotechnologies as emerging technologies because of foreseen possibilities in outworking of new engineering materials for expected applications and also for the simplification of engineering materials manufacturing processes is included to various tasks in that range.

The improvement of properties of applied products required by new strategies of the development of engineering materials including biomedical ones and materials processes technologies defined in the project FutMan is connected very often with suitable formation of structure and properties of engineering and biomedical material surface layers. Functional properties of various products and their elements depend not only on the possibilities of mechanical load through the whole active section of the element from the used materials or from its physical and chemical properties but also very often or mainly from structure and properties of surface layers. As a result of suitable selection of element material together with processes forming its structure and properties and the kind and technology of surface layers ensuring required functional properties the combination of the most advantageous properties of a core and surface layer of a formed element is possible. At present surface gradient materials are very often manufactured. The conception of functionally graded material is connected with materials in which properties are gradually being changed in a constant or discrete way together with the location. Gradient materials properties are achieved thanks to chemical, phase and structure or atom arrangement, which is changed together with the location. It becomes possible among others by methods of thermo-chemical treatment, by composite materials manufacturing and one-layer CVD and PVD coating and also surfacing by welding or spraying of hard layers by the use of metallisation. However, each of those methods have some limitations connected among others with unsuitable thickness of surface layer and mainly with problems connected with unsuitable adhesion of created layer or too big stresses between surface layer and substrate, what is very often the reason of exfoliation or chipping off layers especially in the condition of superposition of internal structural stresses and external stresses resulting from loads in the job condition. Hybrid technologies including among others: processes of thermal-chemical treatment, alloying or laser remelting, powder injection moulding and also physical deposition from gas phase, ensure full and complex solution of the problem of design of materials for suitable applications. It is a modern technological direction and attractive for researches. In that light classic technologies including thermal-chemical treatment become attractive. At present the conception of functional gradient materials including tool gradient materials belongs to one of the most commonly tested in the world, as one of the possibilities of tailoring of properties of various elements and tools for application requirements. In that field the Division of Materials Processing Technologies, Management and Computer Technologies in Materials Science of the Institute of Engineering Materials and Biomaterials of the Silesian University of Technology in Gliwice, Poland has also significant achievements. The concept of gradient structure and materials properties deals most often with surface layers of various groups of engineering materials including constructional, tool, functional and biomedical ones at present. It causes that world scientific centres are interested in that subject matter and even peculiar return of technologies which meaning, as it seemed, became less important previously. Surface treatment through completion of defects in long-exploited elements of machines and devices eg. automotive vehicle and internal combustion engines and formation of structure and properties of reshaped constructional elements can be at present a base of re-manufacturing. New technologies, which belong to a domain of nanotechnology in that range, should be most often implemented because of economic reasons but also ecological ones, and created few-micrometre surface coatings can consist of a few dozen or so layers. Technologies of surface treatment are most commonly used in almost all productive sectors of industry including automotive one, building engineering, medical equipment, sanitary facilities, electrical engineering, electronics and even in jewellery. There are also many other sectors being important receivers of surface treatment including among others: machine and tool building, metallurgical, electrical engineering, electronic, polymer and aviation industry. Defining the leading technologies and directions of strategic researches in the field of methods of engineering materials and biomaterials structure and properties formation is a condition of the outworking of own developmental strategies by many small and medium companies and the improvement of their competitiveness in the domestic and global scale as a result of application and development of advanced technologies of surface structure and properties formation as an essential element of product manufacturing technologies and makes conditions of more elastic adaptation of the production for present market needs. In order to direct the development of the most advantageous technological solutions concerning the structure and properties formation of surface layers of products and their elements, created from engineering materials and biomaterials from the aspect of the improvement of company competitiveness, especially of small and medium ones and the improvement of functional properties, durability and reliability of production, the realisation of the project FORSURF on "Foresight of surface properties formation leading technologies of engineering materials and biomaterials" has begun. The results of the project are addressed to many companies all over Poland and will be used to their pro-innovative activity, contributing to the intensification of transfer of knowledge to economy. The promotion of results and broad application of electronic tools such a webpage, databases concerning technologies of engineering materials and biomaterials and products which can be used, conferences, workshops and seminaries ensure the access to the result of the project to a very broad group of users of its results. The general aim of the project FORSURF financed in the framework of the Operational Programme Innovative Economy and European Regional Development Fund is to increase innovativeness and competitiveness of Polish economy through tightening the cooperation between a research and developmental sphere and economy and especially the adjustment of the subject matter of research works to current and real demands of industrial companies and the increase of involvement of domestic companies in pro-innovative activity, what will result in the increase of absorption capacity of innovation and financing of pro-innovative activity in economy. The main aim of the project FORSURF is the identification of priority innovative technologies and directions of strategic researches in the field of methods of engineering materials and biomaterials surface and properties formation which development will have a key meaning in the country during the next 20 years. The project is realised with the participation of the high level domestic and foreign experts by the application of foresight methodology as important source of a key diagnosis of scientific, economic and ecological problems and the instrument of forecasting and making decisions by domestic authorities managing science, business lobby and institutions of public administration. The identification of priority innovative technologies concerning methods of engineering materials and biomaterials structure and properties formation aims to direct the development of innovativeness of Polish production companies and causing the sustainable economic development in Poland. Pointing out the directions of strategic researches in the field of the subject matter of the project FORSURF is connected with the increase of the Polish science in economy and positive influence on the level of the competitiveness of the Polish researches in the field of science in the European Union and the world. Pro-innovative directions of the domestic scientific researches and the activeness of the Polish companies cause to increase the participation of innovative products in domestic economy and it results in the creation of the numerous new and permanent job vacancies connected with the creation of knowledge-based economy.

In the period of 14th-16th June 2009 in Gdańsk the 1st Workshop in the framework of the project FORSURF being an accompanying event of the Worlwide Congress on Materials and Manufacturing Engineering and Technology COMMENT'2009 is organised. The aim of the FORSURF is a general analysis of the fundamental literature data concerning the state and properties of surface layers and identification of surface layers structure and properties formation and the identification of technologies used in Poland and desired for their development together with pointing out products for which they have to be used in order to choose solutions which are the most effective and necessary for dissemination in industry. The effect of knowledge dissemination in that range among industrial and scientific societies interested in that subject matter and the activation of public debate concerning it creates a good basis to begin researches on identification and next development of leading technologies and strategic researches connected with them in the field of methods of engineering materials and biomaterials properties and structure formation and their products and elements. In the next Issue of Journal of Achievements in Materials and Manufacturing Engineering JAMME the paper on main aims and tasks of that Project will be published. I do hope that the next issues of Journal the next papers popularising the results of the project will be published. I do hope that the next issues of Journal the next papers popularising the results of the project will be published.

In the present volume of Journal of Achievements in Materials and Manufacturing Engineering JAMME we deliver to PT Readers the set of interesting papers. I invite Authors to publish their works in our Journal.

Gliwice, in April 2009

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[1] http://ec.europa.eu/research/industrial_technologies/pdf/pro-futman-doc3a.pdf
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