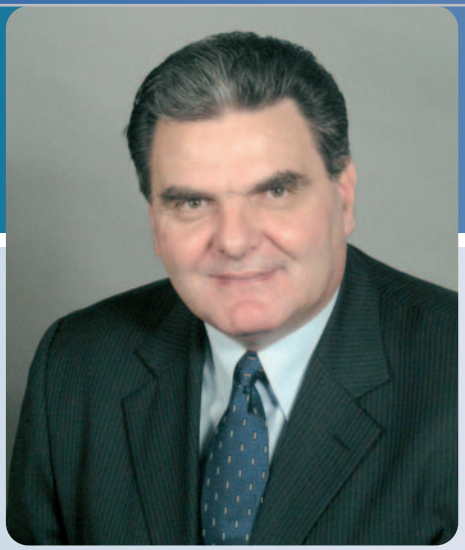
Editorial



The given Issue of the Journal of Achievements in Materials and Manufacturing Engineering includes a few papers worked out by the staff of the Division of Materials Processes Technologies, Management and Computer Techniques in Materials Science on the occasion of the 10th anniversary of the mother Institute. This year for the first time in over 60 years of history of the Institute of Engineering Materials and Biomaterials of the Silesian University of Technology in Gliwice, Poland (the IEM&B of the SUT) created in fact 10 years ago on 1 September 1997 but as successors of the Department of Materials Science created on 24 May 1945 together with the Silesian University of Technology, the conditions for the creation of the branches of studies "Materials Engineering" at the Faculty of Mechanical Engineering of the Silesian University of Technology in which the Institute is the biggest internal unit appeared. There are many factors both external and internal ones which have an influence on the advantageous decision about the branches of studies "Materials Engineering".

Complex requirements put by the developing industry, based on knowledge and closely dependent from the development of information technologies and requirements concerning the application, and especially design of modern engineering materials by the use of contemporary achievements of methodology of materials design and computational materials science with the application of the modelling of structure and properties of computer-aided engineering materials and the field of nanotechnology including design, manufacturing, processing and application of materials and nanostructural systems were a basis of the creation of two new and unique in the State scale macro-branches of studies: "Applied Computer Science with Computational Materials Science" and "Nanotechnology and Materials Processing Technologies" combining in each case curriculum requirements for two component branches of studies which curriculum contents is its basis, that is of "Materials Engineering" and respectively "Technical and Computer Science Education" and "Mechanics and Machines Building". Those totally original curriculum proposals approved by the Council of the Faculty of Mechanical Engineering of the Silesian University of Technology enable to present the totally different educated specialists than so far searched by the industry and prepared for innovative activities connected with design and production of products competitive in a global scale with the use of modern information technologies by the simultaneous ensuring the possibilities of those information technologies in current economic activities of companies, mainly industrial ones (although not only), guaranteeing efficient cooperation with economic and administrative surroundings and also respectively in the field of dynamically developing nanotechnology and with the use of materials, technologies and nanostructural systems. Such a creation of a graduate profile of those macro-branches are especially attractive for industrial companies relying on horizontal industrial politics implemented at present and addressed mainly to a private industrial sector including almost all branches to which come graduates of the Faculty of Mechanical Engineering of the Silesian University of Technology and also industrial companies from sectors of modern technologies increasing their contribution in economy and featuring with a relatively high growth coefficient including nanotechnologies and information technologies. On the other hand such formed profiles ensure great chances for professional development of graduates of those modern macro-branches of studies. The scientific staff of the Institute of Engineering Materials and Biomaterials can see also great chances for the development both for the Institute and also for themselves. They are convinced that those decisions worked out with their participation and among others thanks to their activeness and scientific input are on the one hand a challenge and on the other one are important for the newest history of the Institute.

However, at present in Poland the activities creating conditions for the development of new interdisciplinary industrial sectors having a big growth potential connected with an intensive application of results of scientific researches and developmental works are taken. The necessity of productivity growth and constant decrease of the technological distance of domestic companies in the relation to the ones in the European Union countries and constant decrease of innovative product share in the increasing export was settled down as an important aim of the State politics. It is necessary to build competitiveness predominance of domestic companies enabling fulfilment of requirements of competitors on the global market on the basis of other new sources connected, first of all, with quality, creativity, innovativeness of offered products and acquiring new abilities and application of knowledge by industry in order to work out products having modern functionality and high quality. Raising innovativeness and technological progress in companies require, in turn, significant improvement of qualification of human potential and the adjustment of its structure to the market needs. It is necessary then to intensify and tighten the cooperation of academic centres with the industry and the improvement of human potential by the adjustment of qualifications of graduates offered by education for market needs in industry, raising quality of education in schools at all levels and quality of education and advisory services provided in order to support initiative and also dissemination of a new form of education including e-learning, ensuring better programmes, undergoing stages, professional education and constant training for adults and ensuring emigrating of young and educated people ensuring the achievement of professional specialisation recognised by all European Union countries. The level of the society education and the education system must correspond with requirements of knowledge-based economy because it becomes a more dominating factor in manufacturing goods and services and raising their innovativeness. So a better application of the potential education system in aid of economic growth belong to fundamental tasks in that field. Then it requires the creation of new fields of education better and more fully corresponding with needs of dynamically developing industry. The horizontal industrial politics ensuring sustainable economic, social and environmental development serves for it. This approach of many industries deals with among others: machine-building and automotive, electronic and biotechnological ones in which the share of the employment of graduates of the Faculty of Mechanical Engineering is very significant. Unfortunately, at present in Poland as many as two-third of sold production by industry are products of medium-low and low technology and the contribution of products of high technology is still at average over four times more in import and than in export. It requires then fast and radical changes by the use of economic tools of just implemented horizontal industrial politics. Then the increase of the contribution and relative growth of modern technology sectors among others: information- and nanotechnologies will decide on the competitiveness in the future.

Products and other application goods in which society is supplied on the market and which are supplied by producers mainly by the technical society in which engineers pay a special role – an inspiriting, creative and steering one deciding about a level and quality of life, the exchange of information, the level of education, quality and possibilities of medical service and other aspects of the environment in which we live. Engineering projects are fundamentals of run and realised production. Materials issues play an important role in the realisation of those tasks of the engineering society. Material is then stuff out of which products interesting for clients are manufactured. That is why, the most essential is materials design to create their structure and properties fulfilling requirements in work conditions. Material is stuff at a designer's which must pay attention both to the shape and the form of a product and its element and at the same time decide what that product will be made of, determining in that way about its application and exploitation properties and in the technological progress of that product in order to ensure its shape and required properties. Materials science and engineering similarly to computer science and avant-garde biological and medical sciences belong to the most intensively developing fields of science deciding the human civilisation progress. In the most avant-garde fields of materials engineering the period of knowledge half-expiration is equal 2-3 years. The expired knowledge is replaced by new information. Methodology of materials design and selection decide on market successes of offered products. In order to introduce a new generation of materials and the dissemination of products of expected properties which can be made out of those materials, it is necessary for the familiarisation with behaviour of materials as the ones to the production of new products from a nanostructural through a microstructural to a macrostructural scale by the use of developed analytical technologies and computational materials design and their technologies including a multi-scale one. Applying fundamental principles of physics and chemistry concerning the state and properties of condensed material, theory of materials is used for modelling the structure and functional properties of real materials and design and foreseeing new materials and devices having increased practical usefulness. Modern theory of materials science and modelling are used for the development of new materials. The variety of models applied in computational materials science in relation to the scale and also possibilities of application of materials engineering modelling, their synthesis, properties, structure, properties and phenomena and their experimental verification enabling to check the results of a computer simulation in all scales and methods of artificial intelligence for the application of new materials and processes of their manufacturing. This strategy requires the application of both the improvement of conventional materials such as steel and alloys of non-ferrous metals produced and applied on a mass scale and also to modern functional materials applied in more and more "intelligent" devices. From a point of view of product design all the engineering materials which can ensure the required product properties are equal and multi-criteria optimisation is a base of the selection and the design of material having the best applied and technological properties and the lowest possible costs of manufacturing, processing and exploitation of material and product. Among many criteria bigger significance, expect constructional, technological and exploitation requirements gain also economic and ecological ones. In spite of computer-aided design, materials design, manufacturing, production planning, industrial management, information technologies stimulate also changes in the organisation and business models in companies stimulating their innovativeness and having an influence on production rationalisation and better adjustment to clients' needs. The successful information management is a key element for the growth of virtual networks, small parts processing and limitation of production delays ensuring new quality of cooperation between companies and their surroundings on the basis of electronic documents service, access to data resources and non-limited time and territorial access. It causes a significant reduction of the costs of document service, purchase costs, choice of suppliers and improves a client's service and aids process of planning and control and also enable the improvement of the relations of companies and public administration.

The introduction of new materials and the improvement of materials properties produced so far requires the outworking and the implementation of new methods of manufacturing (synthesis) and processing responsible for high quality and production costs. The knowledge and further familiarisation with numerous phenomena especially in a nanometrical and an atomic scale and taking place in an exceptional short time of femtoseconds enable the adjustment of materials properties including also nanostructural ones to the requirements raised by their practical application. It deals also with nanostructural materials which development becomes especially dynamical ones in relation to a great interest in nanostructural systems and observed intensive development of nanotechnologies. Nanotechnology deals with science and engineering concerning materials manufacturing, functional structures and devices ordered in a nanometrical scale. Taking into consideration that atoms are 0.1-0.4-nm-diameter, nanostructural materials can include a few thousands of atoms. Creating nanostructural engineering materials require then precisions allocation of atoms or their groups and controlling the size and makeup of created grains or blocks and includes unique technological methods. The boom of researches in the field of nanotechnology is dated from the half of the 1990s. At present particles, grains, functional structure and devices which are of the size of 1-100nm although sometimes that range is broadened to 200 nm are treated as nanostructural ones. Quantum dots and wires, grains, particles, nanotubes, nanofibres, nanoboiling, nanocristales, nanoprecious self-organising and thin films, metals, intermetallic phases, semiconductors, minerals, ferroelectrics, dielectrics, composites, alloys, blendes, organic materials, organominerals, biomaterials, biomolecules, polymers, structures and functional devices are included to nanostructural materials. Space technology, aircraft, automotive industry, cutting tool, coatings, X-ray technology, catalysis, batteries, unchangeable memories, sensors, isolators, colour imagining, printers, flat panel displays, modulators, computer chips, magnetooptic discs, photodetectors, solar batteries, optoelectronics, lithography, holography, photoemiters, transistors and switches in particle scale, transport of medicine in organism, medical implants, pharmacy, cosmetics, medicine and micro- and nanoelectromechanical MEMS/NEMS belong to the foreseen application of nanostructural materials. Surely, the nearest years and decades will bring new ideas concerning the application of nanostructural materials and nanostructures in various fields of science and engineering as new technological possibilities of creating materials an atom after an atom on which researches are carried out at present very intensively and as it should be foreseen will be intensified very significantly in the future. Structural materials have different mechanical, electrical, magnetic and optic properties than conventional ones. The application possibilities of an avant-garde and promising group of materials which application are set in various fields are developed. Nanostructural materials achieve important meaning and technology of their production and application getting strong in industry. Nanotechology is a promising and precious way of control of environmentally friendly manufacturing by small and big structures design having complex properties. It is claimed that mirco- and nanosystems are the next logical step in "the silicon revolution". The discovery of new materials, processes and phenomena in a nanoscale and the development of new, experimental and theoretical technologies and researches create new possibilities of the development of innovative nanosystems and nanostructural materials. It is conductive to the increasing of a demand for a new multidisciplinary and system approach to manufacture micro- and nanodevices functioning unreliably. It can be achieved only by the combination of ideas of various disciplines and systematic flow of information and people among research groups and also as results of education of new specialists oriented not only in classic materials processing technologies and also or even, first of all, in the field of nanotechnologies, design, manufacturing, processing and application of nanostructural materials and systems.

The above broadly mentioned issues concerning the developmental technologies of new interdisciplinary industrial sectors using intensively the results of scientific research and developmental works enabling the productivity growth and the contribution of innovative products and constant decrease of technological home industry in the relation to the European Union put the requirements of all institutions and units being a carrier of knowledge-based economy including higher education. Of course, it can be realised by autonomic decisions of the Council of the Faculty of a particular University. Such a decision was also made by the Council of the Faculty of Mechanical Engineering of the Silesian University of Technology from the initiative of the Institute of Engineering Materials and Biomaterials proposing the creation of new and attractive branches of studies. It is a peculiar gift prepared on the occasion of the 10th anniversary of that unit. Moreover, the staff of the Institute of Engineering Materials and Biomaterials and especially of the Division of Materials Processing Technologies, Management and Computer Techniques in Materials Science prepared numerous scientific papers published in that Issue, representing a broad spectrum of scientific interests. I am convinced that they will be an interesting reading for P.T. Readers of the Journal.

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