

# Laboratory classes in materials science and nanotechnology

Collective work edited by Leszek A. Dobrzański and Tomasz Tański

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## ***Abstract***

**Objective:** *The aim of the book is to present 186 completely newly prepared instructions for classes that can be performed on dozens of new research and technological stands in which the Institute has been equipped in recent years. The book is the fourth of the volumes of the tetralogy on materials engineering. The first three volumes were published in the academic year 2012/2013 by the Publishing House of the Silesian University of Technology. This fourth volume in turn was worked out by a team of several dozen co-authors, working at the Institute of Engineering Materials and Biomaterials, Silesian University of Technology. The work has been released thanks to the efforts of the Association of Computational Materials Science and Surface Engineering, and in part from own resources of the authors, who gave up entirely of authors' fees, in the journal entitled "Open Access Library".*

**Design/methodology/approach:** *Practical skills to use very sophisticated research equipment and the knowledge of the many complex research methods in turn enable the characterization of materials and clarification of existing correctness, influencing the structure and properties of materials subjected to different technological processes. A proper selection of material for a given application based on multi-criteria optimization, confirmed experimentally, related to the chemical composition, manufacturing conditions, operating conditions, and the method of removing waste materials in the phase of post-consumer waste, as well as pricing factors associated with the acquisition of the material, its processing into a product, the product as well as the costs of disposal of industrial and used waste, as well as the characterization and modelling of all processes and properties associated with materials, inevitably computer-aided and foresight research and forecasting trends in developmental technologies of materials processes and nanotechnology are important issues solved by materials science and engineering.*

**Achievements:** *The main achievement is the preparation of 186 instructions for laboratory classes in a standardized form that allow students to familiarise with practical aspects on the following specific issues in materials science and nanotechnology: research methods, technological processes, dental engineering and biomaterials, nanotechnology and nanostructured materials, metal alloys, polymers, ceramics and sintered materials, composite materials, computer-assistance and foresight methods in materials engineering, surface engineering and technological processes management.*

**Research limitations/uses:** *In the book only instructions for classes are presented, and a general theoretical introduction is included in the previously released volumes of the tetralogy. Moreover, the preparation of the subsequent books, which will contain detailed information on individual methods and research facilities and technological processes is foreseen.*

**Practical applications:** *The book is the academic textbook that allows students to familiarize themselves with extensive practical knowledge of engineering materials and materials processing technologies, including the most modern ones, within the scope of nanotechnology. It is helpful in gaining practical skills related to the knowledge of technological manufacturing processes and materials processing, including nanostructural ones, and the practical knowledge of technological equipment, which decides of obtaining the desired properties of materials and products made from them. The book can also be useful for teachers and PhD students of universities of technology.*

**Originality / value:** *The originality of the book lies in the unconventional methodological approach in the implementation of laboratory classes in the branch of ordered studies: "Nanotechnology and materials processing technologies", "Applied Computer Science with computational materials science" and "Engineering Materials" including a unique profile of education "Dental Engineering", performed in the framework of the Operational Programme Human Capital in INFONANO, NANATRIM, QUAPINFO and IMOTECH projects.*

**Keywords:** *Materials engineering, nanotechnology, materials engineering, nanostructured materials, test methods, materials processing technologies, dental engineering, biomaterials, metal alloys, polymeric materials, ceramics and sintered materials, composite materials, computer assistance and foresight methods in materials engineering, surface engineering and technological processes management.*

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