Book of abstracts

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MATERIALS SCIENCE MASTERS
UNIVERSITY OF SILESIA IN KATOWICE
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Content

Session 1
Good practices in MSC education - from the perspective of international accreditation committees

USING LEAN MANAGEMENT TO ELIMINATE WASTE IN MATERIALS ENGINEERING EDUCATION

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Lean management is a highly successful approach that has been implemented across various industries for many years. The concept is based on the works of Deming, which were successfully applied in the Toyota Production System, leading to a global quality revolution. Today, the concept of Lean management has been adopted by other sectors such as higher education, research, and public administration.

In daily university life we can face a range of waste sources including duplication, overprocessing, waiting, unclear communication, lost chances for development, unused skills and potential. Lean thinking helps to improve the educational, research, and administrative processes following the principle: Do more with less. Conducting a waste audit and following Lean principles give the possibility to increase the value delivered to the students, academics and admin staff by improving satisfaction and conformance, cycle time, optimising costs and minimising the defects.

The lecture aims to introduce the basics of the Lean concept, explain the idea of waste, and provide practice in recognizing waste in daily university processes. The content of the lecture will be illustrated with case studies and workshops.

GOOD PRACTICES IN TEACHING OF MATERIALS ENGINEERING - SOME IMPRESSIONS FROM POLISH ACCREDITATION COMMITTEE EXPERT POINT OF VIEW

Dariusz OLESZAK

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The Polish Accreditation Committee is an institution acting independently for the enhancement of the quality of education. PAC was established by the minister responsible for higher education and appointed from among candidates proposed by higher education institutions, the Central Council for Higher Education, scientific, professional and artistic associations and employers' organisations. PAC is working according to the Act of 20 July 2018 Law on Higher Education and Science. One of its main objectives is conducting a programme evaluation.

The programme evaluation is based on the several criteria, but from the good practices in Materials Engineering teaching point of view the most important is implementation of the study programme: programme contents, schedule for implementation of the study programme, forms and organisation of classes, methods of education, student placement, organisation of the teaching and learning process. Effective teaching practices in materials science involve a combination of theoretical knowledge, hands-on experiences, and interdisciplinary approaches.

Some good practices are as follow: Engaging Curriculum, Interactive Learning, Interdisciplinary Approach, Research Opportunities, Innovation and Entrepreneurship, Assessment and Feedback, Adaptive Teaching Strategies. Details, including key components of Project-Based Learning and modern methods of teaching and assessment will be discussed.

ACCREDITATION PROCEDURES FOR HIGHER EDUCATION INSTITUTIONS IN TURKEY

Riza KARA

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Accreditation procedures are in most cases considered as a cumbersome duty for the receiving institutions by which a high amount of documentation is required to complete prior to be visited by the committee of accreditation. The reports such as appreciation marking by professors and students are the least to worry about. The reporting about the lecture notes and marks with a corresponding equivalent matchings in learning outcomes and reasoning remarks are also added to reports on the best and worst exam paper for perusal. In this presentation, the accreditation procedures for Turkish Universities will be introduced and an exemplary reporting and procedural reports will be shared. The presentation will also cover the procedures that the committee will take advantage of during the visit to the University such as student opinions and administrative and management procedures etc... It is important to realise that however these procedures are is cumbersome, they usually come with a shining star on the departments and institutions as to show that it has a solid control over the teaching and training as well as administrative duty management, claiming the best teaching practice present in the institution. This presentation will detail the procedures for accreditation of university and department in Turkish Universities.

ELEMENTS OF "MATERIAL SCIENCE" IN MASTER'S PROGRAMS IN THE SPECIALTY 102 "CHEMISTRY", ACCREDITED IN UKRAINE BY 10TH BRUNCH EXPERT COUNCIL "NATURAL SCIENCES"

Hryhoriy DMYTRIV

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In Ukraine 2019 started a new procedure of accreditation of educational programs. During this time 14 master's programs in the specialty 102 "Chemistry", were accredited in Ukraine by the 10th Brunch Expert Council "Natural Sciences". Six of them did not propose any elements that can be applied to the "Material science" educational program. Two programs from the Ivan Franko National University of Lviv, two programs from the Taras Shevchenko National University of Kyiv, and one program from Odesa I.I. Mechnikov National University, Yury Fedkovych Chernivtsi National University, Vasyl Stefanyk Precarpathian National University, and T.H. Shevchenko National University "Chernihiv Colehium" in a different way proposes for master student educational elements which are proposed good practices in "Material science". That are such components: "Functional materials", "Synthesis and physic-chemistry of nanostructured materials", "Applied crystal chemistry", "Methods of investigations of nanomaterials", "Physical basis of nanochemistry and semiconductor chemistry", "Advanced Materials in Chemistry", "Nanochemistry and Nanotechnologies", "New materials in environmental protection technologies", "Functional nanomaterials", "Chemical aspects of creation of the advanced materials", "Methods for determining the structure of chemical compounds and materials", "Solid State Micro and Nanotechnology", "Renewable energy sources". Also, in the mentioned Universities lot of disciplines of free choice of students were proposed which also can be interesting for the master's program "Material Science".

In the presentation, eight educational programs will be analyzed and focused on the components related to the Master program "Material science". Master program "Material science" is very important for enterprises and employment of graduates, especially during the period of post-war reconstruction of Ukraine.

Session 2
Good practices in MSC education from the perspective of universities

EDUCATION IN MATERIALS ENGINEERING IN THE FACE OF DEMOGRAPHIC DECLINE

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The demographic decline significantly affects the number of candidates for studies, especially in a field such as materials engineering. The presentation introduces to the current situation in materials engineering studies at three levels of education in Poland and discusses possible actions aimed at increasing the number of students.

THE CRISIS AT UNIVERSITIES. HOW TO RESPOND TO THE DEMOGRAPHIC DECLINE?

Artur DURAJSKI

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Universities globally are facing a significant challenge, marked by a declining demographic of prospective students. It is worth examining the root causes and implications of the crisis, emphasizing the need for innovative and adaptable responses from universities. Proposed solutions encompass various approaches, including strategic marketing to attract diverse student populations, fostering international collaborations, and adapting curricula to align with job markets and societal needs. Moreover, collaborative efforts between academia, policymakers, and industry stakeholders are highlighted as essential for revitalizing the higher education landscape amidst demographic challenges. Based on activities undertaken at the Faculty of Production Engineering and Materials Technology at Częstochowa University of Technology, we present potential good practices aimed at getting young people interested in studying technical fields such as materials engineering.

MATERIALS ENGINEERING 2ND DEGREE AT LUT: CHALLENGES OF RECRUITMENT PROMOTION AND DIDACTICS

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The field of study of Materials Engineering (ME) has been operating exclusively as a 2nd degree since 2021. During this time, we have successfully conducted promotional and recruitment activities twice. The result was the enrollment of about 20 students for each two consecutive academic years (2021/22 and 2022/23). The paper will present the promotional activities undertaken to support the recruitment of the ME field and their effects.

To promote the field of study, open days and special lessons for students and high school students are also organized. Candidates have the opportunity to get acquainted with the teaching offer and our laboratories. There are also 2 scientific circles within the ME field, where students develop their passions and interests.

In 2023, the ME field of the study was evaluated by the Polish Accreditation Commission. The main conclusions of this evaluation will also be presented. We can consider it a huge success that the students of the ME field receive the highest grades within the Faculty of Mechanical Engineering. At the same time, the teachers in the ME field are very highly rated by the students.

A MODERN APPROACH TO ENGAGING STUDENTS ON THE EXAMPLE OF THE FACULTY OF MATERIALS ENGINEERING OF THE SILESIAN UNIVERSITY OF TECHNOLOGY

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The Faculty of Materials Engineering at the Silesian University of Technology in Katowice is achieving good results in activities that inspire students to contribute to science, society and the environment. Students learn how to solve problems of a technical, organizational, and materials science nature by carrying out projects during a certain predetermined time frame within the framework of Project Based Learning (PBL). In addition, the combination of scientific circles from different fields of study in one space has helped develop common concepts for research and project work.

SHOULD WE EDUCATE STUDENTS IN SPECIALTIES OR MORE GENERAL ENGINEERING? EXPERIENCE OF RECENT YEARS IN MATERIALS SCIENCE EDUCATION

Tomasz KOZIEŁ, Piotr BAŁA

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Recent years' experience regarding education in materials engineering at the Faculty of Metals Engineering and Industrial Computer Science, AGH University of Krakow will be presented. A few years back, specializations were abandoned at our Faculty, and we educated students on diploma paths with a large pool of elective subjects chosen by the students. It led to a situation in which our graduates needed better feedback regarding their preparation for entering the employment market. Corrective actions have been introduced, including a return to specializations, while creating a new program of study based on extensive consultation with potential employers. Another, no less important aspect of the changes, was the introduction of changes in third-level education by the Higher Education Law. Aspects of education at the Doctoral School and its impact on the quality of doctoral students, PhD theses and the scientific development of PhD students will also be presented.

CRYSTAL CHEMISTRY AS A TOOL FOR MATERIALS DESIGN

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Crystal chemistry explores the relationships between chemical composition, crystal structure, and physical-chemical properties of solid-state matter, which can then be used to develop new materials with tailored properties. Phase diagram investigations provide information about the conditions of formation of compounds, and the stability with respect to composition, temperature and pressure, based on experimental observations. Crystal structure determinations tell us how the atoms are arranged and their preferred coordination environments, and the comparison of different structures shows how more complex structures can be formed from simpler ones by applying building principles, such as intergrowth, deformation, substitution, removal of atoms, filling of vacancies, modulations. The database PAULING FILE, which stores experimental data on constitution (60'000 phase diagram entries), structure (400'000 crystal structure entries), and properties (200'000 physical property entries), offers a holistic view on inorganic compounds and constitutes a data source for machine learning. The usefulness of crystal chemistry as a tool for materials design will be illustrated on examples including heterogeneous catalysts, superhard materials, materials for hydrogen storage, thermoelectrics, magnets, and superconductors.

IMPROVING PRESENTATION SKILLS IN THE FIELD OF MATERIALS ENGINEERING

Filip PASTOREK

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High-quality information and education that you have but cannot use and sell properly are like fertile land that you own but on which nothing grows. In the dynamically evolving and interdisciplinary field of materials engineering, effective communication is paramount to sharing research findings, fostering collaboration and advancing the field. This presentation explores the use of strategies and best practises aimed at enhancing the presentation skills of materials engineering students to increase their applicability and success in practise and in business. In the contribution, Ing. Filip Pastorek, PhD. shares his experience of using the presentation skills acquired during his studies at the Department of Materials Engineering at the University of Žilina in his career as a product manager in an international company and subsequently as a director of a research institution. His goal is to contribute to the improvement of didactics in the field of materials engineering by bringing pedagogical insights and practical experience in designing engaging presentations, engaging diverse audiences and effectively communicating complex scientific concepts.

AN ATTEMPT TO CHARACTERIZE THE CULTURAL SPECIFICITY OF THE EDUCATION PROCESS AT UNIVERSITIES IN SOUTHEAST ASIA

David VOKOUN

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The cultural specificity of the education process at universities mainly in China is discussed. The author deals only with the education process applied in technical fields. The presentation highlights the importance of educational diversity and gives some examples of the local specificity and distinct features of the Chinese education process for technical fields.

Session 3
Good practices in MSC education from the perspective of industry

LEVERAGING TRAINING WITHIN INDUSTRY (TWI) FOR STUDENT EDUCATION: A CASE STUDY ON TEACHING STATISTICAL PROCESS CONTROL (SPC)

Dobrochna SZTAJERSKA

Cavalry Captain Witold Pilecki State University of Małopolska in Oświęcim, Oświęcim, Poland

The roots of Training Within Industry (TWI) trace back to World War II when the program's implementation empowered American companies to swiftly train a large workforce, filling the void left by those engaged in the war effort. Although the post-war era in the USA saw a lapse in TWI adoption, struggling Japanese companies, notably Toyota, embraced these concepts. Remarkably, the TWI job instruction program continues to be a cornerstone in Toyota's global team training initiatives. Recently, there has been a resurgence of interest in TWI in the USA and other nations.

A pivotal TWI tool is job instruction—a four-step methodology designed to teach the correct, safe, and consistent execution of tasks while meeting all requirements. The four steps encompass:

1. Employee preparation.
2. Job presentation.
3. Hands-on application of new skills on the job.
4. Performance verification.

This training methodology involves observing the work, receiving a detailed description of the tasks, immediate hands-on practice, task summarization, and continuous support until competence is achieved. The expedited skill acquisition translates into heightened quality and productivity within organizations.

This instructional approach is transferrable to student education, particularly in practical subjects involving software, machinery, and devices, where time constraints are prevalent.

The incorporation of TWI elements into education will be exemplified through the teaching of Statistical Process Control (SPC) to future engineers using Statistica software. The presentation will encompass the method of knowledge transfer, sample instructions utilized during classes, and the outcomes of the final examination for students taught through both traditional and TWI-influenced methods.

INDUSTRY SURVEY AND ITS ROLE IN COURSE SELECTION PROCESS IN DEVELOPING A NEW MASTERS DEGREE: MATERIALS SCIENCE MA(S)TERS PROGRAM

Şükrü TALAŞ

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The institutional teaching is always practically important to the students as it is the source of organised knowledge as well as the centre of production of knowledge by research. This has been challenged in recent years with a drop in the number of students in engineering sciences, if not, the focus of students are shifted towards the more popular career where the problem still lies unsolved. This problem is totally related to the change in the behaviour of preferences of students who want to gain a degree in Masters in engineering as they are more involved in starting a business or more interested in working in a reliable and institutional company/government. This is brings another challenge; academicians are not competent to replenish as the experience is not mounted up, that is, the lecture timings and syllabus modifications towards the need of these working students has to be redefined and new didactics are needed. In this context, the developing a master's degree program in Materials Science has been initiated in 2022 in order to bring a new concept of teaching and training didactics in order to help masters students acclimate to research and teaching life. For this purpose, and within the context of Materials Masters project, a survey on the type of teaching, number and type of lectures was performed on approximately 200 students who had completed their MSc or studying in an MSc program, and, the output suggests that the section of teaching method is as important as the selection of lectures. The selection of lectures, as the survey suggests, may not be as it is predicted by an academician. The students are more interested in theoretical lectures as they feel compelled to learn more on the

background or mechanisms of processes as they are already familiar to the practice in their workplace, or they mostly work as R&D personnel. This presentation will detail the course content selection process based on the data obtained through aforementioned survey and its findings.

SUPPORTING THE EDUCATIONAL PROCESS THROUGH INDUSTRY COLLABORATION

Joanna ZDUNEK

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In the dynamic landscape of education, creating solid partnerships with industry is a milestone for supporting education. This abstract explores a multifaceted approach to supporting the educational process by aligning academic programs with the ever-evolving needs of the socio-economic environment. Emphasizing the importance of industry collaboration, our initiative at the Warsaw University of Technology – Materials Science and Engineering Faculty focuses on creating innovative educational programs responsive to industry demands and catalyzing student success in the professional realm.

Key initiatives include organizing events that facilitate study circles providing a platform for students to engage in collaborative learning experiences. These events serve as dynamic forums where academia and industry converge, fostering an exchange of ideas and expertise. Furthermore, implementing projects within the educational curriculum is a tangible measure of our commitment to practical, industry-relevant learning. Students gain invaluable hands-on experience by incorporating real-world projects, bridging the gap between theory and practice.

To deepen the integration of academia and industry, we advocate for organizing seminars that facilitate direct interaction between students and the economic environment. These seminars serve as catalysts for networking, mentorship, and knowledge exchange, empowering students with insights into the professional landscape they are poised to enter. Through these initiatives, we aim to cultivate a learning environment that transcends traditional

boundaries, preparing students with academic knowledge and the critical skills and insights needed for success in their chosen industries.

This abstract encapsulates our commitment to a symbiotic relationship between education and industry, fostering an adaptive and responsive learning ecosystem and preparing students for the challenges and opportunities of the socio-economic landscape.

MATERIALS SCIENCE AND ENGINEERING EDUCATION PRACTICES IN TURKEY: ENGINEERING AND TECHNOLOGY FACULTIES

Aytekin HITIT

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Materials Science and Engineering and also Metallurgical and Materials Engineering departments are majorly working in the same field of teaching and also research. Although the differences are basically on the perspective on the research field and variations on the number and the type of lectures, there is another issue in the application field; engineering and technology faculty syllabus differences. Both engineering and technology faculties are capable of training engineers in materials science however the conceptual vision states that engineering faculties are more towards theoretical whereas faculty of technology leans towards more application based syllabus education. Faculty of technology is completely composed of 7 teaching term and one training term in industry with two consecutive summer training or internships involving 45-60 working days in an industrial organisation with materials science or metallurgical engineer present, whereas most engineering faculties, although it is changing rapidly, are composed of 8 teaching terms with summer internships involving 40 – 45 working days in an industrial organisation with Materials Science or Metallurgical Engineer present. In this presentation, the differences in training and education will be explained and the best teaching practices will be shared with outcome such as the ratio of students finding job following the graduation or the type of jobs they land on etc...

PRACTICAL USE OF MATERIALS ENGINEERING ON A SERVICE (MAINTENANCE) DEPARTMENT

Matej BARLOK

TDK - Slovakia, s.r.o. / Maintenance Engineer, Slovakia

Practical examples of using knowledge of materials engineering in a service (maintenance) department oriented on CNC machining technologies, autonomous vehicles (AGV) and other machine devices use in the production. Examples of used technologies – vibrodiagnostic, thermodiagnostic, tribodiagnostic and etc. – to perform failure mode and effect analysis and reasons of downtimes. Application of knowledge into continuous improvement of service and maintenance activities on devices to ensure reliability and availability of devices.

SOLVING OF PRODUCTION ISSUES AND COMPONENT FAILURES WITH MATERIALS ENGINEERING KNOWLEDGE

Libor TRŠKO

Výskumné Centrum, Žilina

Many of engineering failures and customer claims are a result of missing knowledge in material behaviour with respect to various production technologies and mistakes in material properties testing methodology. Ing. Libor Trško, PhD. during his career cooperated with a number of leading industrial companies in solving of production issues, assisted in several research and development projects and worked for five years as tribology and materials engineering expert in a company manufacturing hydraulic components. In his presentation he describes several industrial problems which were caused by insufficient understanding of material properties, their interactions and improper testing methodology. The aim is to point out potential blind spots in education process and to show that the materials engineering knowledge, even when seems to be very theoretical, has a huge direct impact on quality, reliability and cost efficiency of industrial production.

TEACHING, PROJECT SELECTION AND TRAINING PRACTICES IN INDUSTRIAL R&D DEPARTMENTS: CASE STUDY IN ŞAHINKUL MACHINE MANUFACTURING INC. CO.

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Research Institutions and Universities are in general places where the project is received and executed using governmental and institutional recipient funds, however, the private institutions that has research and development department or centres has to execute the projects in a subtle way that is the R&D department most of the time use the own resources to bring a project to the end. In this presentation, we will present how a training is carried out and planned in R&D department in Sahinkul Machine Manufacturing Ltd.Co. Different to the training in Institutions and Universities, the staff in commercial units is more deeply focused on the outcome of the project and the financial outcome is also one of the most eagerly awaited yield in addition to another tick in the to-do list Ministry of Industry and Technology in order to take advantage in taxes such as corporation tax. However, since the focus is mainly on the successful outcome, training and teaching has to be done through private companies and academics. In this presentation examples of training and teaching for R&D staff will be examined and various experiences in project selection and related teaching and training practices will be shared to present if reasonable didactics are involved.

COOPERATION OF SCHAEFFLER KYSUCE WITH UNIVERSITY STUDENTS AND ABSOLVENTS

Rastislav MINTÁCH, Martin SOPKO

Schaeffler Kysuce, Slovakia

Schaeffler Kysuce belongs to the one of the biggest plants in Europe focusing not only on the production of standard bearings (as clutch, tension, or wheel bearings) but also on electronic parking brakes, ball screw linear drives, intelligent active roll control systems and electrical axles.

The plant also includes a R&D department and a materials and chemic research laboratories. The material laboratory has several methods of analysis as standard metallographic research of materials, optical emission spectrometry methods (OS, GDOS), X-ray diffractometry method, light microscopy and SEM/EDX and mechanical testing (tensile/compressive stress machine). Workplace also focus on field failure analyses from customer. Cooperation with neighboring universities is also part of the department's activities. As part of their standard or PhD studies, students undertake a fellowship, gaining knowledge and practical experience in the field of measurement and evaluation. Part of the cooperation is the investigation of the properties of materials, the influence of heat treatment and surface treatment of components in the framework of diploma and PhD theses. Several of our employees are graduates of the material engineering departments. They can directly use their university knowledge and confront it with real practice. Industry-university cooperation benefits both sides in terms of education, experience and the supply of “clever minds” from foreign countries.

INSTITUTIONAL TRAINING AND TEACHING PRACTICES IN MATERIALS SCIENCE AND ENGINEERING SECTION AT RESEARCH FACILITIES: CASE STUDY AT BORON INSTITUTE

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The training and education in research centres or institutes have to be relatively different than those of Universities and Teaching Institutes. Education and training at every level of teaching status is primary duty of universities, however, the institutes, especially research institutes are different in terms of teaching and training levels. There has to be high level of training and education in order to complete the projects and therefore both training and teaching are more advanced since the academic level of personnel employed in research institutes are undergraduate level at minimum. In this case, training and subject schooling level has to be adjusted to meet the level of Masters to be comparable. The educators should also be of highly experienced in research and training in order to make a sufficient contribution. This presentation will present the guidance coaching and educational procedures and training routines employed in Materials Science research group in Boron Research Institute, Turkish Energy, Nuclear and Mineral Research Agency Boron Institute. Various procedures for staff training for project preparation and conventional equipment and relevant background characterisation and theoretical training will also be mentioned in detail.

Workshop

HOW TO REDUCE THE WASTE OF TIME IN THE UNIVERSITY PROCESSES? USING VALUE STREAM MAPPING IN IMPROVING THE ORGANISATION OF THE TEACHING AND LEARNING PROCESS IN MATERIAL ENGINEERING.

Justyna MACIĄG

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The cutting funds, rapid changes driven by new technologies, the changing expectations of students, employees and other university stakeholders, internationalisation and growing competition require a new approach to governance and management of the universities. Improving the effectiveness and quality is a constant challenge for leaders, managers, academics and admin staff. Old-fashioned management philosophy and methods no longer work in today's university. Therefore, the critical issue is to increase the value delivered to the student and university stakeholders by optimising actions and processes within the university. This is idea of the Lean thinking which focuses on eliminating waste in the processes.

The workshop aims to introduce Value Stream Mapping (VSM), which is the basic technique and tool used in Lean management. VSM helps to analyse all actions within a process, starting from a customer and moving along the value stream towards resources necessary for conducting a process, producing a product or providing a service. The essence of mapping is to show these actions which create value and to eliminate or minimize those that do not contribute to the creation of values (are sources of waste). The key notions in VSM include value and waste.

The workshop consists of two parts: the first part is dedicated to giving a background referring to the key notions in VSM including value and waste, and Lean principles; the second part requires attendees to observe the process,

prepare the process map, use the waste audit to find the sources of wastes and ideas how to reduce the waste, and then prepare the final project of the process map and test it (validate it). This workshop aims to provide competence in using powerful tools to reduce waste in the teaching and learning process in Material Engineering.

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MATERIALS SCIENCE MASTERS

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MATERIALS SCIENCE MA(S)TERS

developing a new master's degree

MATERIALS SCIENCE MASTERS

UNIVERSITY OF SILESIA IN KATOWICE

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