1.	Field of study	Materials Science and Engineering
2.	Academic year of entry	2017/2018 (summer term)
3.	Level of qualifications/degree	second-cycle studies
4.	Degree profile	general academic
5.	Mode of study	full-time

Module: Unconventional techniques for materials manufacturing

Module code: IM2A_NTWM

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
IM2A_NTWM_1	Understanding relationships between the structural perfection and parameters and conditions of single-crystals production, understanding phenomena of kinetic and thermal processes proceeding during a single-crystal growth and solidification of composite materials, including those of single-crystal matrix.	IM2A_W06 IM2A_W07	2 2
IM2A_NTWM_2	Learning basic methods for producing and characterising single-crystals and composites with a single-crystal matrix as well as aviation superalloys monocrystalline on a macroscopic scale, and also phenomena, processes proceeding on the crystallisation front.	IM2A_W06 IM2A_W13	3 2
IM2A_NTWM_3	The skill to analyse phase diagrams in view of possibility to produce single-crystals of predetermined phase composition and the skill to choose a method for obtaining a specific material.	IM2A_U11 IM2A_U19	2 2
IM2A_NTWM_4	Development of the awareness of the need for obtaining monocrystalline materials of predetermined structure.	IM2A_K04	2

3. Module description

Description	The module Unconventional techniques for materials manufacturing shall enable that students are knowledgeable about methods for monocrystalline materials production and shall enable understanding mechanisms of their growth and the formation of a real structure. Owing to that and based on the analysis of phase equilibrium diagrams they will be capable of analysing the course of single-crystals growth and of predicting the chemical and phase composition as well as the kinetics of their crystallisation. These capabilities apply also to the production of complex polyphase materials monocrystalline on a macroscopic scale, including aviation monocrystalline superalloys. This module will provide students with an additional possibility to learn methods for structural perfection assessment of monocrystalline materials. Owing to that students shall achieve a better understanding of correlations between the structure of monocrystalline materials and conditions of their producing, which in turn will enable obtaining the skill to form the structure and properties of monocrystalline materials by appropriate conditions of their producing.
Prerequisites	It is required to achieve effects of education of the modules: physics, chemistry, crystallography, materials testing methods and thermodynamics.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
IM2A_NTWM_w_1	Written test	Verification of the knowledge based on the lectures content, recommended literature and attended classes.	IM2A_NTWM_1, IM2A_NTWM_2, IM2A_NTWM_3, IM2A_NTWM_4
IM2A_NTWM_w_2	Written test	Checking the acquired knowledge of analysis and of mechanisms for single-crystals structure forming and of mechanisms for development of polyphase materials monocrystalline on a macroscopic scale.	IM2A_NTWM_1, IM2A_NTWM_2, IM2A_NTWM_3, IM2A_NTWM_4
IM2A_NTWM_w_3	Report	Assessment of the skill to understand mechanisms for monocrystalline materials structure forming and to predict results of the production process in a form of properly formulated conclusions.	IM2A_NTWM_3, IM2A_NTWM_4

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
IM2A_NTWM_fs_1	lecture	The lecture shall enable understanding issues related to mechanisms of structure and defects of monocrystalline materials development, phenomena and processes on the solidification front, which in turn will allow obtaining the planned structure of those materials. The lecture is delivered with the use of multimedia.	30	The work with the recommended literature comprising independent acquisition of knowledge related to basic issues.	10	IM2A_NTWM_w_1
IM2A_NTWM_fs_2	laboratory classes	Application of the acquired theoretical knowledge in practical learning of production methods, including directional crystallisation methods, monocrystalline materials and mechanisms enabling forming their structure and properties. Exercises are performed by students individually with the use of equipment of teaching and scientific laboratories.	45	Preparation of theoretical basics and issues related to the topic of performed exercise. Independent preparation of a theoretical introduction. Individual preparation of exercise results.	5	IM2A_NTWM_w_1, IM2A_NTWM_w_2, IM2A_NTWM_w_3