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| The title of the course | **Materials Science: Heat Treatments (HT)** |
| Faculty | [Faculty of Mechanical Engineering and Computer Science](http://eng.ath.bielsko.pl/index.php/faculties/gerg) |
| The level of studies | Undergraduate (BA) |
| Semester | Winter/summer |
| The form of classes and number of hours | Laboratory/Project 15h/15h |
| Language of instruction | English |
| The number of ECTS | **2 ECTS** |
| Teacher | Dr hab inż. Dariusz Jędrzejczyk |
| The aims of the course | The course aim is to take a closer look at the knowledge regarding the heat and thermo-chemical processing of different alloys (steel, cast iron, aluminium alloys) . During lectures the scientific basis of physic-chemical processes concerning the heat processing will be presented. Also dependence of treatment parameters on the Fe-C equilibrium diagram will be discussed especially in the case of steel and cast iron. Principles of the basic parameters of processing choice, as : the heat-up time, the time and the temperature of heating up, the cooling rate will be analysed. A difference between tempering and aging will be highlighted. Students will will analyse the application of heat treatment with respect to thehigh quality alloys (MARAGING steel, ADI cast iron, aluminium alloys 7000 series) |
| The content of the course: main topics and key ideas | Seminars (4h)   1. The basis of Fe-C alloys (cast iron, steel) heat treatment - Fe-C equilibrium diagram, structures characterization, basic transformations – 2h 2. Relation between Fe-C equilibrium diagram and the parameters of the heat treatment, hardening and tempering results, comparison to heat treatment of aluminium alloys – 2h   Laboratories (6h)   1. Heat treatment parameters choice with reference to carbon steel- microscopic observation, hardening experiment – 2h 2. Tempering of carbon steel – real experiment and effect evaluation – hardness measurement, microscopic observations 3. Effect evaluation of steel carburizing, nitriding and other thermo-chemical treatment – microscopic observations |
| Didactics methods | Multimedia presentation, discussion – seminars,  Real experiment - laboratory |
| Course requirements | Exam/attendance |
| Literature (basic and supplementary) | Basic:   1. Ashby M.F., Shercliff, Cebon D., Materials: engineering, science, processing and design, Butterworth-Heinemann, 2013 2. Ashby M.F., Materials Selection in Mechanical Design, Butterworth-Heinemann, 2004 3. Rajan T.V., Sharma C. P., Sharma A., Heat Treatment: Principles and Techniques, PHI Learning Private Limited, New Delhi, 2011. 4. Dossett J.L., Boyer H.E., Practical Heat Treating, ASM International 2006, 5. Kaufman J.G., Properties of Aluminum Alloys: Fatigue Data and the Effects of Temperature, Product Form and Processing   Supplementary:   1. Cardarelli F., Materials Handbook, Springer, 2nd ed., 2008 2. Weng Y., Dong H., Gan Y., Advanced Steels, Springer and Metallurgical Industry Press, 2011 3. Callister D.W., Rethwisch D.G., Materials Science and Engineering: An introduction, 8th ed. Wiley, 2013 4. Joseph R. Davis, Cast Irons, ASM International, 1996 5. Weng Y., Dong H., Gan Y., Advanced Steels, Springer and Metallurgical Industry Press, 2011 |
| The effects of the education   * knowledge * skills * social competences | (K) Is able to: select the parameters of HT; evaluate and measure the effect of HT,  (Sk) Is able to perform the heat treatment of Fe-C alloys  (So) Be aware of responsibility for own work and is ready to comply with rules of cooperation in team |