

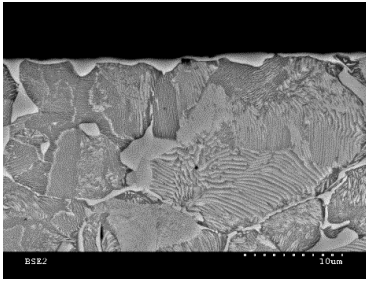




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<b>name of the unit:</b> <b>DIVISION OF SURFACE ENGINEERING AND HEAT TREATMENT</b> Institute of Materials Science and Engineering , Lodz University of Technology		<b>symbol:</b> <b>I-11</b> <a href="http://www.iim.p.lodz.pl">http://www.iim.p.lodz.pl</a>
<b>head of the unit:</b>  Dr hab. inż. Konrad Dybowski, prof. uczelni	<b>potential promoters:</b>  Prof. dr hab. inż. Leszek Klimek Dr inż. Bartłomiej Januszewicz Dr inż. Radomir Atraszkiewicz	<b>contact person:</b>  Bartłomiej Januszewicz tel: 42-631-30-50 <a href="mailto:bartlomiej.januszewicz@p.lodz.pl">bartlomiej.januszewicz@p.lodz.pl</a>
<b>scope of activities:</b> The scientific activity of the division mainly includes research in the field of heat treatment of metal alloys, including thermo-chemical treatment. In the framework of the conducted research, the technology of low-pressure carburising (vacuum carburizing) and nitriding or the world's unique technology of low-pressure carburizing with preliminary nitriding has been developed and implemented into industry. The division has a unique technological laboratory with equipment for heat treatment in vacuum, in reactive and inert atmospheres, where research can be conducted on the development of new technologies from fundamentals to the pre-implementation scale.		<b>graphic material</b>   
<b>present activities:</b> Currently, the scope of activity of the division includes research on application of low-pressure carburizing technology to treatment of other metal alloys and other, non-standard types of steel. The division also conducts research into the application of graphene produced by metallurgical methods on a liquid copper substrate. Research is also being conducted on the application of graphene-based composites for water purification.		
<b>Future activities:</b> Development of low-pressure carburizing technology, research on practical application of graphene, development of graphene-based composites for water purification.		
<b>Publications/patents, awards, projects:</b> <ol style="list-style-type: none"><li>1. Graphene-based composite materials for water purification – project NCBR: POIR.04.01.04-00-0089/15</li><li>2. G. Romaniak, K. Dybowski, A. Jędrzejczak, A. Sobczyk-Guzenda, J. Januszewicz, W. Szymański, P. Kowalczyk, T. Kaźmierczak, J. Siniarski, P. Kula: Impact of a graphene oxide reducing agent on a semi-permeable graphene/reduced graphene oxide forward osmosis membrane filtration efficiency, "Membranes", 2021, 11, 9, DOI 10.3390/membranes11090679</li><li>3. Kowalczyk, P.; Dybowski, K.; Januszewicz, B.; Atraszkiewicz, R.; Makówka, The Hybrid Process of Low-Pressure Carburizing and Metallization (Cr + LPC, Al + LPC) of 17CrNiMo7-6 and 10NiCrMo13-5 Steels, Coatings 2021, 11, 567., <a href="https://doi.org/10.3390/coatings11050567">https://doi.org/10.3390/coatings11050567</a></li></ol>		



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4. Dybowski, K., Romaniak, G., Kula, P., Jeziorna, A., Kowalczyk, P., Atraszkiewicz, R., Kolodziejczyk, L., Nowak, D., Zawadzki, P., Kucinska, M., Impact of the method of separating graphene from the growth substrate on the quality of the 2D material obtained (2019) Archives of Metallurgy and Materials, 64 (4), pp. 1321-1326,
5. Dybowski, K., Kowalczyk, P., Kula, P., Jeziorna, A., Atraszkiewicz, R., Kołodziejczyk, Ł., Zawadzki, P., Nowak, D., Kazimierczak, T., Kucińska, M., Graphene-based composite membrane for water desalination, (2018) Archives of Metallurgy and Materials, 63 (3), pp. 1379-1383
6. Dybowski, K., Sawicki, J., Kula, P., Januszewicz, B., Atraszkiewicz, R., Lipa, S., The effect of the quenching method on the deformations size of gear wheels after vacuum carburizing, Archives of Metallurgy and Materials, 2016, 61 (2B), pp. 1057-1062.
7. Dybowski, K. ; Kowalczyk, P.; Januszewicz, B.; Batory, D., Advances In Science And Technology-Research Journal, Hybrid layer type Cr/LPC, 2017, Volume: 11, Issue: 2, s. 23-27
8. US 9 284 640, USA, Method of producing graphene from liquid metal, P. Kula, A. Rzepkowski. R. Pietrasik, R. Atraszkiewicz, K. Dybowski, W. Modrzyk – patent
9. EP2865637B1 Nanocomposite based on graphene for reversible storage of hydrogen, Piotr Kula Antoni Rzepkowski, Robert Pietrasik, Radomir Atraszkiewicz, Konrad Dybowski, Lukasz Kaczmarek, Wojciech Modrzyk – patent
10. EP2865646B1, Method of producing graphene on a liquid metal, Wojciech Modrzyk, Piotr Kula, Antoni Rzepkowski, Robert Pietrasik, Radomir Atraszkiewicz, Konrad Dybowski – patent
11. PL229687, A method for controlling the grain size of primary austenite formed in steel by heat treatment or thermo-chemical treatment in a vacuum, Dybowski K., Rzepkowski A., Rzepkowski A. – patent
12. PL416797, Method of producing a hybrid layer on a substrate of iron or its alloys, Dybowski K., Kowalczyk P., Atraszkiewicz R., Januszewicz B. – patent
13. PL430830, Filtration composite membrane and a method for its fabrication, Dybowski K., Kula P., Jeziorna A., Romaniak G., Sinarski J., Kaźmierczak T. – patent
14. PL428718, Method of fabricating composite electrodes for water electrodeionization based on cross-linked graphene oxide, Dybowski K., Kaczmarek Ł., Kula P., Szymański W., Warga T., Romaniak G., Bucholc B., Makowicz M., Sinarski J., Kaźmierczak T. - patent

**Keywords:**

heat treatment, thermo-chemical treatment, carburizing, nitriding, graphene, water treatment

**List of internship proposal in this research team:**

1. The development of low-pressure carburizing process for austenitic stainless steels,
2. The development of the process of low-pressure carburizing of titanium alloys
3. To investigate the effect of pre-nitriding on the structure of alloy steels subjected to carburizing.