SOME ASPECTS OF INTENSIFICATION THE CAST IRON SMELTING

DYCHKOVSKYI Roman[1] & GOLOVCHENKO Anatoliy[1]
[1]Dnipro University of Technology, Dnipro, Ukraine

Purpose. Using the conical backfilling system and principles of thermodynamic conversion was providing technical and technological insuring the process of iron smelling for providing minimal coke losses.

Methodology. The studies were carried on using special equipment for providing the trajectory and fulfilling of coke and iron ore according the quantity proportions and qualities of inputting material and providing the final characteristics of the product. All this activity allows to manage the melting process.

Findings. It is proposed that the coal mining and power energy generation development just now have a huge problem.

The paper represents the analysis, which has helped to determine the spreads and treands in in cast iron smelting in blast furnaces. The thermodinacic processes, which are based on Nijman criterion, allows to describe the common processes in blast furnaces with high level of accordance. Provided practical researches shown that the furnaces during iron smelting are under complicate processes, which are really hard to estimate only theoretically. Thermodynamic processes are defined as very difficult in such an environment to physically lay sensors that could take into account the geometric shape of the charge. So, it is proposed to use the developed special devices for determining the geometrical parameters of iron smelting material in the furnace. Such equipment has the title a gamma locator. Its allows to fix the fluidized state of the charge on the blast furnace grate. It makes possible to keep almost virtually horizontal surface on the grate after the next supply of the appropriate portion of material. On this basis, it is proposed to adapt different ways of feeding the charge into the blast furnace to more efficiently ensure the melting process. The economic indicators of the proposed technological solutions are given.

This work contains the research, which was conducted within the projects: TrainESEE: Training trainers in East and Souteastern Europe and DIM ESEE: Dubrovnik International ESEE Mining School (within the framework of EIT Raw Materials).

Article is dedicated in memoriam of ***Anatoliy* Golovchenko**

Keywords: thermodynamic modelling, iron ore, smelting, blast furnace, conical backfill, coke, economical issues

Reference

1.Pedchenko, L., Nyemchenko, K., Pedchenko, N., & Pedchenko, M. (2018). Use of alternative energy sources to improve the efficiency of natural gas hydrate technology for gas offshore deposits transportation. Mining of Mineral Deposits, 12(2), 122-131. https://doi.org/10.15407/mining12.02.122

2. Thomas, H. R., Hosking, L. J., Sandford, R. J., Zagorščak, R., Chen, M., & An, N. (2019). Deep Ground and Energy: Carbon Sequestration and Coal Gasification. Proceedings of the 8th International Congress on Environmental Geotechnics Volume 1, 38–60. https://doi.org/10.1007/978-981-13-2221-1_2

3. Golovchenko, A. (2020). Some aspects of the control for the radial distribution of burden material and gas flow in the blast furnace. Energies, 13(4), 923-926 https://doi.org/10.3390/en13040923

4. Golovchenko A.S. (2000). Declarative patent of Ukraine # 31478. The Way of Blast Furnace Melting Conducting. Bulletin of Inventions, # 7-11

5. Golovchenko, A, Pazynich, Yu, Potempa, M. (2018). Automated Monitoring of Physical Processes of Formation of Burden Material Surface and Gas Flow in Blast Furnace. Solid State Phenomena, (277), 54-65. https://doi.org/10.4028/www.scientific.net/SSP.277.54

6. Golovchenko A.S. Declarative patent of Ukraine (2000). # 31479. The Device for Determination of Level and Profile of Materials Surface. Bulletin of Inventions, # 7-11

7. Dychkovskyi, R.O. (2015). Determination of the rock subsidence spacing in the well underground coal gasification. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, , 6, 30-36.

8. Pivnyak, G., Dychkovskyi, R., Bobyliov, O., Cabana, E. C., & Smoliński, A. (2018). Mathematical and Geomechanical Model in Physical and Chemical Processes of Underground Coal Gasification. Solid State Phenomena, 277, 1-16. https://doi.org/10.4028/www.scientific.net/ssp.277.1

9. Perkins, G., du Toit, E., Cochrane, G., & Bollaert, G. (2016). Overview of underground coal gasification operations at Chinchilla, Australia. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 38(24), 3639–3646. https://doi.org/10.1080/15567036.2016.1188184

10. Dychkovskyi, R., Tabachenko, M., Zhadiaieva, K., Dyczko, A., & Cabana, E. (2020) Gas hydrates technologies in the joint concept of geoenergy usage. E3S Web of Conferences, 230, 2021, 01023. https://doi.org/10.1051/e3sconf/202123001023

11. Ge, S. (2017). Chemical mining technology for deep coal resources. Zhongguo Kuangye Daxue Xuebao/Journal of China University of Mining and Technology, 46(4), 679-691

12. Sobolev V., Cabana Caseres E., Howaniec N., Dychkovskyi R., Jura B., Bąk A., & Smoliński A. (2020) Estimation of dense plasma temperature formed under shock wave cumulation. Materials, 13(21), 4923, 2020. https://doi.org/10.3390/ma13214923

13. Chernai, A.V., Sobolev, V.V., Chernai, V.A., Ilyushin, M.A., Dlugashek, A. (2003). Laser ignition of explosive compositions based on di-(3-hydrazino-4-amino-1,2,3-triazole)-copper(II) perchlorate. Combustion, Explosion and Shock Waves, 39 (3), 335-339

14. Dychkovskyi, R.O. Forming the bilayer artificial shell of georeactor in underground coal gasification. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu 2015, 5, 37-42.

15. Pivnyak, G., Dychkovskyi, R, Bobyliov, O., Cabana, C.E., Smoliński, A. Mathematical and Geomechanical Model in Physical and Chemical Processes of Underground Coal Gasification. Solid State Phenomena 2018, 277, 1-16. https://doi.org/10.4028/www.scientific.net/SSP.277

16. Falshtynskyi, V.S. (2017). Formation of thermal fields by the energy-chemical complex of coal gasification. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 5, 36-42.

17. Volodymyr Falshtynskyi, Roman Dychkovskyi, Pavlo Saik, Vasyl Lozynskyi, Victor Sulaiev, Edgar Cáceres Cabana (2019). The Concept of Mining Enterprises Progress on the Basis of Underground Coal Gasification Method Characteristic. Materials Properties and

Technologies of Processing /Solid State Phenomena. Trans Tech Publication Ltd: Zurich, Switzerland (291), 137-148. https://doi.org/10.4028/www.scientific.net/SSP.291.137

18. Tabachenko, M. (2016). Features of setting up a complex, combined and zero-waste gasifier plant. Min. Miner. Depos., 10(3), 37-45. http://dx.doi.org/10.15407/mining10.03.037

19. Pazynich, Y., Kolb, A., & Potempa, M. (2017). Implementation of Energy Safety Policy in Ukraine by Means of Energy Saving in Electric Drive Systems. Advanced Engineering Forum, (25), 96-105. https://doi.org/10.4028/www.scientific.net/aef.25.96

20. Declarative patent of Ukraine # 37426. The method of determining the distribution of materials in the blast furnace. *Bulletin of Inventions*, # 7-21

SOME ISSUES OF THE THIN COAL EXPLORTION AT JSW GROUP MINES

DYCHKO Artur[1] & DUPLIAK Maria[2]

[1]*Jastrzębska Spółka Węglowa S.A. (JSW Group), Jastrzębie-Zdrój, Poland*

[2]*Dnipro University of Technology, Dnipro, Ukraine*

Purpose. Carrying out the research for application of the extraction technologies for thin coal seams at JSW Group mines at economically expedient level.

Methodology. Applying the methods of mathematical statistics, as well as the assessment of existing technological solutions in mining, the possibility of technical and technological justification of the thin coal seams mining at an economically feasible level.

Findings. Global trends in the development of coal deposits show different approaches to standardization of reserves and the application of standards to their assessment. Today, in Poland, to thin seams are included reserves with formations less than 1.5 m thick. However, directly in this structures the significant reserves of coal in mines are concentrated. This means, that these reserves are defined as off-balance. So they are not economically feasible for extraction by existing mining equipment. At the same time, the practice of mining reserves, even with a smaller thickness, is quite widespread in other countries. In particular, in Ukrainian mines for a long period have been effectively mined the coal seams below 1.2 m. There are also other positive examples of mining equipment usage in such conditions. Therefore, the article considers the possibility of introducing technical and technological improvements for the extraction of off-balance reserves at JSW Group and other polish mines. Along with technical improvement, an economic assessment is conducted, which proves the validity of the proposed approaches.

The study was conducted as part of the individual researches of the author.

Key words: mining, thing coal seam, technology, technical occupation

References

1. Kopacz, M., Kulpa, J., Galica, D., Dyczko, A., & Jarosz, J. (2019). Economic valuation of coal deposits – The value of geological information in the resource recognition process. Resources Policy, 63, 101450. https://doi.org/10.1016/j.resourpol.2019.101450