

Optimization of charge material composition in shs process with ferrosilide fabrication from gaseous wastes of metallurgical production

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Abstract

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Keywords

Disperse mechanical engineering waste products, Ferrosilide, Integral quality coefficient, Minimization, Objective function, Optimization, Self-spreading high-temperature synthesis

References

- [1] Safronov G. N., Safronov N. N., Kharisov L. R. SHS-Ferrosilide Anode-Grounders for Electrochemical Corrosion Protection. Saarbrücken, Germany: Lap Lambert Academic Publishing, 2014. 140 p. ISBN 978-3-659-53065-4
- [2] Safronov G. N., Safronov N. N., Kharisov L. R. Corrosion-resistant high-silicon cast iron chemical engineering components. Chemical and Petroleum Engineering. 2015. Vol. 51, No. 1. pp. 142-144. DOI: 10.1007/s10556-015-0014-3.

- [3] Safronov G. N., Safronov N. N., Kharisov L. R. Analysis of SHS-Ferrosi-lide Crystallization Conditions and Microstructure. Metal Science and Heat Treatment. 2015. Vol. 57, Iss. 5-6. pp. 317-319. DOI: 10.1007/s11041-015-9882-6.
- [4] Duvigneaud P., Tanghe M. Ecosystemes et Biosphere. Translated from French. Moscow: Progress, 1973. 267 p.
- [5] Human Development Report 2006/2007. Fighting climate change: Human solidarity in a divided world. Published for the United Nations Development Programme (UNDP). 1 UN Plaza, New York, 10017, USA. 2007.
- [6] Baoding Liu. Theory and Practice of Uncertain Programming. Translated from English. Moscow: BINOM. Laboratoriya znaniy, 2005. 416 p.
- [7] Tom Rath, Jim Harter. Well Being: The Five Essential Elements. Moscow: Alpina Publisher, 2011. 148 p.
- [8] Saaty Thomas L. On the Measurement of Intangibles. A Principal Eigenvector Approach to Relative Measurement Derived from Paired Comparisons. Cloud Of Science. 2015. Vol. 2, No. 1.
- [9] Mitikhin V. G. About one contrary instance for hierarchy analysis method. Problemy upravleniya. 2012. No. 3. pp. 77-79.
- [10] Saaty Thomas L. Decision-making. Hierarchy analysis method. Moscow: Radio i svyaz, 1989.-316 s.
- [11] Bobro Yu. G. Alloyed cast irons. Moscow: Metallurgiya, 1976. 288 p.
- [12] Krasnov M. M. Optimal parallel algorithm of calculation of points of a computational front hyper plane and its comparison with other iteration methods of solving of grid equations. Preprinty IPM imeni M. V. Keldysha. 2015. No. 20. 20 p.