International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-12, October 2019

Technological Processes of Receiving Metals in The Conditions of Moderate Temperatures

Sokhibjon T. Matkarimov, Sardor Q. Nosirkhudjayev, Qakhramon T. Ochildiyev, Oybek U. Nuraliyev, Begzod R. Karimdjonov

In article questions of physical and chemical transformations of starting materials at their heating in metallurgical furnaces are considered. It first of all moisture evaporation, dissociation of the difficult connections, oxidizing and recovery processes, formation of fusible eutectics. An attention to interaction of oxides and sulfides with formation of the new connections having smaller melting point than initial components. It is shown that these connections are the beginning of formation of melts and actually define thermodynamics and kinetics of all process. Transition of firm components of fusion mixture to flux has a great influence on technological indicators of smelting of metal. Considering it, the research on establishment was conducted began courses of these of reaction and a possibility of determination of this criterion without direct the made experiments.

***Keywords*: solid fusion mixture, heating, physical and chemical transformations, moisture evaporation, dissociation of the difficult connections, simple components, chemical reactions, fusible eutectic, fusion, theoretical definition, beginning of chemical reactions.**

I. INTRODUCTION

The metallurgy is one of the leading branches of economy of Uzbekistan. From its improvement social and economic development of our republic in many respects is defined [1].

For all the metallurgy bases centuries-old history on application two classical technological processes – pyrometallurgical and hydrometallurgical.

In pyrometallurgical processes implementation of physical and chemical transformations for the purpose of extraction of metals from ores proceed in the conditions of high temperatures and it is frequent with fusion of all of mass of materials. The main processes proceed in a temperature interval of 1250-1680 °C in a condition of various gas atmospheres.

Revised Manuscript Received on October 30, 2019.

***** Correspondence Author

Matkarimov Sokhibjon Turdaliyevich*, Assistant professor, PhD, Department of Metallurgy, Tashkent State Technical University, Tashkent, Uzbekistan. Email: sohibtm@gmail.com

Nosirkhudjayev Sardor Qodirdjon ugli, Senior teacher Department of Metallurgy, Tashkent state technical university,

Ochildiyev Qakhramon Toshtemirovich, Assistant Department of Metallurgy, Tashkent state technical university,

Nuraliyev Oybek Ulugbek ugli, Assistant Department of Metallurgy, Tashkent state technical university, University Street 2, Tashkent, Uzbekistan,

Karimdjonov Begzod Rakhmatjonovich, Senior teachers, Department of Metallurgy, Tashkent State Technical University, Tashkent, Uzbekistan. Email: mr.berdiyarov@mail.ru

For implementation of high-temperature recovery roasting of ores to a metal state various methods are offered and tested in laboratory and semi-industrial scale. Use as reducer of steam coal or a coke trifle is provided in them [2].

In hydrometallurgical processes physical and chemical processes proceed in water and salt solutions. This type of reactions in some cases proceeds with participation of organic solvents or sorbents at normal or elevated pressures in the conditions of temperatures 20-200 ^{0}C.

Possibilities of improvement of these two technological directions, generally are already substantially exhausted and hardly here it is necessary to expect new breakthrough decisions. For this reason for the last decades are not realized in industrial scale new technological processes. Researches after improvement of hardware registration of processes and creations of new designs of furnaces are generally conducted [3].

At the same time, a number of shortcomings from which the main are are peculiar to these two technological processes:

1) high expense of different types of energy and material resources;
2) need to involve a large number of the equipment;
3) exit of a large number of waste and semi-products of technology;
4) quite low coefficient of complexity of use of raw materials;
5) harming of ecology and need of acceptance, special measures for environmental protection, etc. [4].

In our opinion, the new direction in metallurgy in which the main technological processes will be can be very perspective it is carried out in the conditions of moderate temperatures 600-1100 ^{0}C. At the same time as active chemical reagent superheated water vapor will be used. Its opportunities far are not studied and not completely estimated the prospect of application yet. The fact that superheated steam very actively enters chemical interactions with natural minerals [5] is known.

II. RELETED WORK

Among variety of the metallurgical processes using steam as the main and auxiliary reagent, the important place is taken by physical adsorption - one of the main stages in interaction of steam with solid material. Such processes are called top chemical. The reactionary ability of substance depends on the size of adsorption. A quantitative measure of such ability is the specific speed of reaction.

In interaction of a solid body with a gaseous phase of E.V. Morgulls offered so-called adsorptive – the dissosiational theory [6].

The essence of the theory is as follows. It is supposed that as a result of chemisorption of oxygen on the surface of sulfide the peroxide complex which decays with release of atomic oxygen is formed.

The last reacts with the next molecules of sulfide again. Thus, on the surface of sulfide metastable sorption complexes with the increasing saturation oxygen turn out. As a result of such processes sulfates which not only are well dissolved when leaching turn out, but also increase in concentration is promoted by sulfate of ions in solutions [7].

The analysis of the data which are available in literature allows to define the perspective directions of use of water vapor for improvement of metallurgical processes. In particular it can be the intensification and improvement of processes of roasting of sulphidic minerals, use as a temperature regulator of exothermic reactions, creation of essentially new process and the device of melting of sulphidic minerals in which combination two stages: oxidations of sulfides water ferry and restoration of oxides: It will allow to receive from sulphidic material the metallized product [8].

III. OBJECTS AND METHODS OF RESEARCH

The pyritic concentrate is itself of great value for all metallurgy in general. All the matter is that it contains 35-42% of Fe, 0,30-0,48% of Cu, 0,055-0,060% of Mo, 3,0-4,0 g/t of Au, 9-15 g/t of Ag and it is a lot of other valuable components. Desulphurize iron can be good raw materials for ferrous metallurgy, and copper, gold, silver and other non-ferrous metals can become sources of additional receiving products at steel works [9].

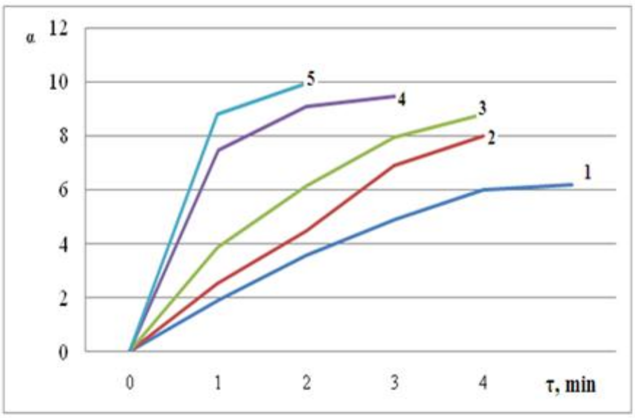
IV. RESULTS OF THE RESEARCH

At Metallurgy department of the Tashkent state technical university researches on oxidation of sulfides of iron are conducted by water vapor. Interactions of FeS with H_2O can be described by the following reactions [10]:

$FeS + H_2O = FeO + H_2S$ (1)

$3FeS + 10H_2O = Fe_3O_4 + 3SO_2 + 10H_2$ (2)

In the first series of experiments we investigated influence of temperature on extent of desulfurization. Experiments were made in a temperature interval 900-1150^{0}C. Concentration of water vapor in blasting made 50%. Results of researches are presented in fig. 1.

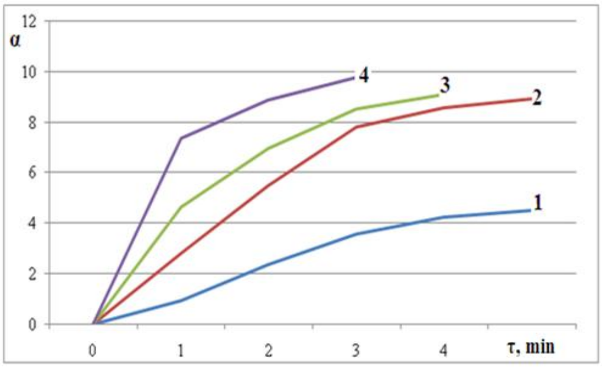


1-1100 ^{0}C, 2-1150 ^{0}C, 3-1200 ^{0}C, 4-1250 ^{0}C, 5-1300 ^{0}C

Fig. 1. Change of extent of desulfurization (α) FeS depending on experience duration at different temperatures

Apparently from rice-1 extent of removal are gray on reactions (1) and (2) significantly rises with growth of temperature. Already at a temperature of 1250 °C in 2 minutes about 90% of all sulfur of furnace charge are removed. Further, the speed of removal of sulfur slows down a little that apparently is caused by diffusive difficulties of an exit of sulfur from sulfide volume on its surface.

Determination of optimum moisture content in blasting is of practical interest. Results of the researches conducted by us in this direction are presented in fig. 2.

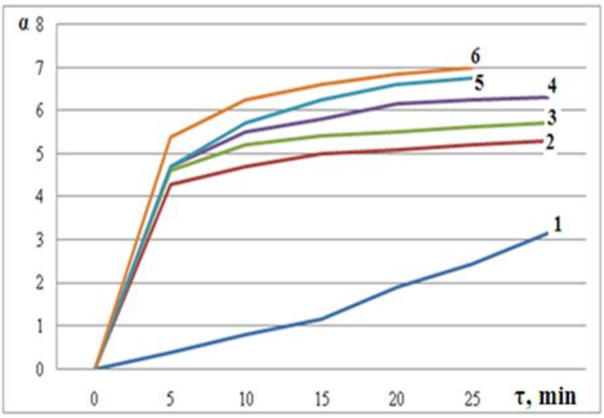


1-25%, 2-50%, 3-75%, 4-100%

Fig. 2. Influence of content of water vapor in blowing on extent of removal are gray in time. t = 1250 °C

Data in fig. 2 convincingly show increase in extent of desulfurization with growth of the contents of water vapor in blasting. At partial replacement of air with water vapor, rather large amount of nitrogen is entered into the calcination furnace. This element renders influence on a reactionary surface is picturized and significantly reduces thereby course of reaction of oxidation of sulfur and its removal in the form of gases.

The conducted researches showed a possibility of processing of sulfides of iron water vapor at high temperatures. For the purpose of creation of energy saving technologies, we conducted special researches on release of sulfur at falls of temperature. Results of researches are presented in fig. 3.



1 - 300 °C, 2 - 400 °C, 3 - 500 °C, 4 - 600 °C, 5 - 700 °C, 6 - 800 °C

Fig. 3. Change of extent of removal are gray when roasting FeS in time in current of water vapor

The hind legs of curves in fig. 3 are stood by their uniformity change only qualitative showed. The largest speed of oxidation is observed the first minutes of roasting with the subsequent its falling to zero.

International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-12, October 2019

This results from the fact that the first minutes of roasting as a result of course of chemical reactions (1) and (2) on the surface of sulfide of iron the firm film is formed of its oxides which picturizes. At the same time a reactionary surface process passes into diffusive reactions in which the speed of reaction is defined by diffusion of the reacting components by an oxidic film. At low temperatures the speed of diffusion of components is small and it defines reduction of speed and depths of removal are gray from sulfide. From the technological point of view removal of sulfur more than for 90% is quite enough for use of iron in ferrous metallurgy as left sulfurs without difficulties is removed by the subsequent preparation of this material for metallurgical conversion.

V. CONCLUSION

The complex of the conducted researches showed that iron sulfides after their processing in current of superheated steam quite, can be used as initial raw materials for receiving iron, copper, gold, silver and other metals. This technology is rather simple and can be realized on the available equipment in AMMC. Iron sulfides, after roasting in BL furnaces, are exposed to wet magnetic separation the iron concentrate goes to receiving steel and cast iron. The separation tails containing significant amounts of copper of gold and silver can be loaded into the melting furnace and is processed with acceptable technical and economic indicators.

REFERENCES

1. Mirziyoev Sh.M. Ensuring rule of law and the interests of the person – a guarantee of development of the country and wellbeing of the people. – Tashkent: Uzbekistan of NMIU, 2017 - 48 pages.
2. Matkarimov S.T., Berdiyarov B.T., Yusupkhodjayev A.A. "Technological Parameters of the Process of Producing Metallized Iron Concentrates from Poor Raw Material," Int. J. Innov. Technol. Explor. Eng., vol. 8, no. 11, pp. 600–603, Sep. 2019.
3. Corty G, Anderson and Robert G, Dunne Mineral processing and Extractive metallurgy: 100 Years of Innovation Feb. 18. 2014.
4. John Persy. Metallurgy: The Art of Extracting metals from Their ores and Adapting Them to Vorious Purpose of Manufacture: 2012.
5. MalyshevaT.Ya., Dolitskaya O.A. Petrography and mineralogy of iron ore raw materials. M.: MISIS. 2016 – 424 pages.
6. Vanyukov V. A. V.Ya. hares. Theory of pyrometallurgical processes. M.: Metallurgy of 2017 - 514 pages.
7. Charles Herman Fulton. Principles of metallurgy: An Introduction to the metallurgy of the metals 2012.
8. Yusupxodjaev A.A. Nosirkhodjaev S.Q. Matkarimov S.T. Karimjonov B.R. Phisical and chemical transformations of components of fusion mixture of their heating in metallurgical furnace.: International journal of advanced recеach in science, engineering and technology. Vol. Issue I. January 2019.
9. Wilheen Borches; Metallurgy: A Basic Outline of the modern processes for extracting the more important metals (Classic reprint). 2012.
10. Yesin O.A. Geld P.V. Physical chemistry of pyrometallurgical processes. M.: Metallurgy of 2017 - 671 pages.

AUTHORS PROFILE

Matkarimov Sokhibjon Turdaliyevich, Assistant professor Department of Metallurgy, Tashkent state technical university, PhD
University Street 2, Tashkent, Uzbekistan, 100095
E-mail: sohibtm@gmail.com
Phone number: 99897 330-21-01

Nosirkhudjayev Sardor Qodirdjon ugli, Senior teacher Department of Metallurgy, Tashkent state technical university,
University Street 2, Tashkent, Uzbekistan, 100095
E-mail: s.nosirkhudjayev@gmail.com
Phone number: 99897 749-36-34

Ochildiyev Qakhramon Toshtemirovich, Assistant Department of Metallurgy, Tashkent state technical university,
University Street 2, Tashkent, Uzbekistan, 100095
E-mail: q.ochildiyev@mail.ru
Phone number: 99899 810-20-97

Nuraliyev Oybek Ulugbek ugli, Assistant Department of Metallurgy, Tashkent state technical university,
University Street 2, Tashkent, Uzbekistan, 100095
E-mail: o.nuraliyev@mail.ru
Phone number: 99894 408-09-09

Karimdjonov Begzod Rakhmatjonovich, Assistant Department of Metallurgy, Tashkent state technical university,
University Street 2, Tashkent, Uzbekistan, 100095
E-mail: b.karimdjonov@mail.ru
Phone number: 99890 908-82-52