RESOURCE SAVING TECHNOLOGY IN METALLURGY

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The main charge material for the steel production is liquid hot metal. Ukraine occupies the eighth place in the world by the steel production after Chain, Japan, USA, Russia, South Korea, Germany and India. The total amount of the world steel production in 2006 was 1239,5 mln.t, Ukraine had produced 40,8 mln.t. It is mainly produced in blast furnaces. The blast furnace operates according to the counter-current principle. The process makes the blast furnace reliant on lumpy materials to maintain a gas-permeable stock column. The most important reducing agent is therefore the lumpy coke. Auxiliary reducing agents, such as coal or oil, are injected via the tuyeres.

The consumption of coal and coke in the blast furnace is met on the one hand by the market or on the other hand by the own production. It depends on the conditions of the market and the availability of production facilities. World-wide the production of hot metal and crude steel via the blast furnace/converter route is regarded as the dominant process line also in future. Consequently, after their successes in the past, the ironmaking and steelmaking industry have joined their efforts with the cokemaking industry to exploit still more development potentials for hot metal production.

Coke is very deficient, and its production leads to the great amount of harmful emissions to the environment. So it is necessary to find materials in blast furnace to substitute coke. Such auxiliary reducing agents are coal, oil, gas and old plastics, which are injected via the tuyeres to the blast furnace. In the past coke was replaced by oil and during the last decades more and more by coal.

The use of coal, oil or gas depends on the economical result of BF-operation.

The technology of pulverized coal injection (PCI) has reached a high standard. All high productivity BF are equipped with PCI-facilities.

Since 80th years in the countries of Europe and Asia a coal becomes the basic type of the blown fuel. Presently more than 100 pulverized coal complexes work in the countries of Europe, China, Japan, Korea, the USA and other countries. Perfection of technique and technology of dust coal fuel injection leads to achievement of stable charges him at the level of a 150-200 kg/t cast-iron.

At the given technology there is a lot of advantages: reducing of power intensity of cast-iron production, its prime costs, possibility of using cheap brands of coals, reduction of expense of coke (on 40-50%) and natural gas, improvement of ecological performance indicators of enterprises.

A coke is the major and irreplaceable component of blast-furnace charge, as it provides a process by a high temperature heat, gas-penetrability of charge on all height of stove, carbonization of cast-iron.

However simultaneously with the invention of cast-iron there was a no less intricate problem consisting in the reducing of specific expense (kg/t cast-iron) and gross production volume of coke. Actuality of this task is determined by the high cost of coke, continuously increasing scarceness and cost of the coked coals, by worsening of their quality, by extremely negative influence of coking process at the ecological situation in the industrial regions. So, at production of a 1 mln t coke in an atmosphere 7000-10000 t of harmful matters are thrown out, including 2,7000 t of dust; 3,4000 t of sulfur gases; 0,16000 t of nitrogen oxides and etc.; upcast in the water pools of 0,5-0,7 mln.m^3 muddy waters (phenol, thiocyanates, benzol, weighed matters and etc).

At the same time the production of one million of t dust coal fuel is accompanied less amount of the harmful emissions to the atmospher: dust coal – 32,0 t; carbon oxide - 93,6; nitrogen oxide - 37,6; sulphurous anhydride - 53,0 t, that at replacement of part of coke by PCI determines considerable reduction of contamination of environment by the harmful emissions.

It has to be noted that the blast furnace process produces its reducing gas inside the furnace itself. As the coke is the most expensive charge material of the blast furnace the operators replace coke

partly by injection of carbon and hydrocarbon carries via the tuyeres using high blast temperatures and oxygen to guarantee a suitable flame temperature and a fully gasification rate of the injectants to reducing gas.

The injection of coal leads to an optimization of the process chain. The replacement ratio of coke to coal is in the range of 0.9 to 1.0; so it saves costs, as the injection of coal requires only 20 % of the specific investment costs for a coking plant and only 30 % of the processing costs. For the amount of coal injected the BF slag partly takes over the purpose of the coking plant by-product processing facility.

At individual blast furnaces coke rates of below 300 kg/t HM have been achieved by the injection of coal.

Nevertheless coke will remain the most important reductant in the future.

Coke plays a triple role in the blast furnace, namely a physical, thermal and chemical role but it is very deficient, and its production leads to the great amount of harmful emissions to the environment.

Thus, the technology of the blast-furnace melting with pulverized coal injection allows to reduce the rate of expensive and deficient coke, to bring down cost of cast-iron smelting, to decrease negative influence of the harmful emissions of coke production on environment.