

# THE COAL PREPARATION WASTES USE IN THE METALLURGICAL PRODUCTION

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The final results of the coal flotation wastes use, as the partial substitute of the coke nut at the agglomeration and, as the warming smoldering insulation for the filling of the ingot head part of the dead melted steel have already been given in this paper.

**The Key Words:** coal preparation waste, agglomeration, coke nut, insulated filling, dead – melted steel (killed steel), ingot.

The work efficiency of the metallurgical enterprises cannot be considered beyond the challenges of the rational use of the natural resources. So, in the metallurgical production, it is inevitable the adverse products and their wastes are being formed, which, on one hand, the large losses of the mineral raw materials are made up, and, on the other hand, the large damages are caused the environment.

The single way of the production wastes localization has been the garbage removal into the dumps for a long period of time, however, in the recent years, the methods of their disposal and further utilization are being actively developed. Thus, the complete use of the secondary material resources under the contemporary economic conditions is one of the perspective ways to be reduced the energy resources consumption.

The raw materials and materials costs in the economic balance of the JSC «ArcelorMittal Te Myrtana» are occupied about 70%, which is determined the low – waste and waste – free technologies organization, as one of the most significant and important challenges. Despite of the significance and economic reasonability of more complete secondary resources processing, their use level is still insufficient.

The flotation wastes, due to the lack of the simple and economically cost – effective preparation technologies to their utilization and re – cycling, as well as, due to the instability of their chemical and granulometrical compositions are remained not needed and are cast into the tailing – storages. At the metallurgical enterprises of the SIC countries, the flotation wastes are, practically, utilized slightly. So, for example, today, total more than 40 mln. tons of the flotation wastes have been accumulated in the tailing – storages No.2 and No.3 of the JSC «ArcelorMittal Te Myrtana» .

In the world practice, the main perspective consumers of the flotation wastes have already been determined, the recommendation on the wastes use in the different fields of industry have been made up. The following directions and its trends of the flotation wastes utilization have been received

the maximal spreading: the using in the building industry [1, 2]; the addition of the dried wastes in the grouting mortars during the gas wells drilling [3]; the using in the agriculture [4, 5].

So, the flotation wastes using, as the energetically – fuel potential is related to among the most perspective directions. The reserve of the wastes thermal energy is sufficient for the electric power station's work provision, having capacity of 20 MWt. Such wastes can be burned in the furnace plants, having worked by the “fluidized bed” method. Thanks to the temperature level reducing of the burning up to 750 – 850<sup>0</sup>C in the furnace (NTKS), the nitrogen oxides formation and discharge into the atmosphere are considerably reduced, and at the supply with the limestone fuel – the sulfur dioxide [6].

At the JSC «ArcelorMittal Te Myrtana» the studies have been carried out on the flotation wastes utilization and re – cycling at the HES – PVS, which were then shown the possibility of their using, as the partial substitute of the solid fuel. At some enterprises, the studies on the deficit types of the fuel replacement by the alternative cheaper carbon – containing materials (e.g. hard coal, etc.) have been carried out. So, for example, at the JSC «ArcelorMittal Te Myrtana», for the purpose of spending reduction of the coke breeze, the hard coal has been used, as the fuel component of the agglomerate. As a result, it has been received the significant saving from the fuel cost price reduction. For all this, the agglomerate quality is not deteriorated, under condition of the regimes rational adjustment of the substitute preparation by the coke breeze to the sintering [7].

The literary references analysis has been shown the absence of any experience of the flotation wastes using at the enterprises of the ferrous metallurgy. It, moreover, has been found, that the utilization of the dewatered flotation tailings can be carried out similarly to the existing methods of the carbon – containing materials using. That is why, it has been taken into account the scientific and technical information, on the hard coal using in the metallurgical production, which are quite similar in their characteristics to the flotation wastes.

The flotation wastes utilization in the metallurgical production, as the fuel, carbon and slag – forming materials, can be provided the significant saving of the cast iron, lime, to be improved the produced and smelted steel quality, to be reduced the main and auxiliary materials spending in the different productions of the complex enterprise. The flotation wastes realization by the foreign building organizations for the building items and articles production will allow to be obtained the additional income by the JSC «ArcelorMittal Te Myrtana». The natural materials replacement by the flotation wastes will be preserved the environment and, moreover, will be reduced the ecological payments for its further pollution.

At the JSC «ArcelorMittal Te Myrtana» the studies on the flotation wastes using have been conducted at the agglomerate – production [8]. The experienced sintering has been performed at the laboratory agglomerate – merational installation with the 250 mm diameter bowl. Then, the agglomerate – factory No.2

with the different contents of the flotation wastes of the coal preparation in the fuel mixture has subjected the furnace charge by the agglomeration.

The specific performance of the installation, the vertical speed of the sintering, the conditional cake cooling rate, the recovery yield, the mechanical strength of the agglomerate for the impact and wearing out have been monitored from the output parameters.

So, the studies' final results have been shown, that the single – layered sintering, the partial replacement of the coke breeze by the coal preparation flotation tailings is resulted in the vertical speed of the sintering, the cake quality deterioration, and the general over – fuel consumption. The introduction of 1% flotation wastes is reduced the vertical speed of the sintering for 0,1 mm/min., the specific performance for 0,007 t/m h. By the further introduction up to 11% of the flotation wastes – the recovery yield is, practically, increased by 0,56% for every 1% of the wastes, and then, it is being decreased with the same ratio.

So, the fuel consumption final analysis has been shown, that at the entering into the fuel mixture up to 10% of the wastes, it is permanent (e.g. 95 kg/t of the agglomerate), then, it is drastically being increased with the ration of 1,09 kg/t of the agglomerate for 1% of the wastes.

At the two – layered sintering, the input into the furnace charge of 5% of the flotation wastes is, practically, resulted in the increase of the vertical speed of the sintering for 1,3 mm/min, the specific performance for 0,08 t/m h, the recovery yield of the agglomerate – 0,1%, the mechanical strength of the agglomerate for the impact and wearing out – 1,7 and 0,2%, respectively. So, the further increase in the proportion of the wastes is resulted in the decrease in the height of the high layer by 1,5 mm for 1% of the wastes and the recovery yield.

During the laboratory tests conducting, the concentrations in the exhausted gases SO<sub>2</sub> and NO<sub>x</sub>, in comparison with the conventional burdening at the single – layered sintering have, practically, been remained at the same level, and at the two – layered one – the quite slight their increase has been observed. Thus, the flotation wastes involvement into the production does not significantly change the ecological parameters of the process.

So, the final results of the industrial – experimentally studies on the replacement of the coke breeze part by the flotation wastes at the 5-th aggro-machine of the aggro – factory No.2 with the environmental assessment of such replacement have already been confirmed the final results of the laboratory studies. It, moreover, has been established, that the high performance ensuring and the reduced emissions of the polluting substances are, practically, achieved at the coke replacement by the flotation wastes in amount not more, than 10%.

In the moulding – foundry workshop (MFS) the industrially – experimentally tests of the flotation wastes have already been carried out, as the heat – insulating filling of the steel ingots, instead of the used asbestos backfilling, which is, environmentally, harmful [8].

The flotation wastes have been deposited on the caked head surface of the ingot. The ingots had been obtained with the closed shrink basin, that prevented the metal carburization. At the flotation wastes burning, more prolonged time (e.g. up 2 hours) the high temperature of the head surface of the ingot had been maintained, and, as a result, the metal was longer in the liquid state under the caked bridge. The gas cavity, having formed between the caked bridge and the liquid metal, has prevented the heat removal in the vertical direction. So, the closed shrink basin has allowed to be excluded the oxidizing gases penetration through the bridge, in the process of the heating during further ingots' processing.

In the experimental ingots, the exposure duration before the flotation tailings deposition on the head surface of the ingots, has been varied within 5 – 120 s. By using the flotation passages, the humidity less, than 10%, the amount of the dust in the exhausted gases from the moulds is being, considerably, decreased, and it is at the level of 10 – 40 mg/ m<sup>3</sup>. At the killed steel casting into the MFS molds, the ingots insulation by the flotation wastes does not result in the defect emergence through the cracks and the metal carburization. All the received ingots of the MFS are practically used in the forge – and – press workshop for the work piece blanks' and performs manufacture, having undergone the further necessary processing in the mechanical workshops.

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