

## PUTTING INTO PRACTICE MODERNIZED TECHNOLOGIES AND DEVELOPMENT OF PROSPECTIVE DIRECTIONS IN ORE PREPARATION



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The most significant expenditures at the concentration factories are stipulated by the ore preparation: capital -50-60%, operational - to 80%.

The more efficient ore treatment at GOKs is possible under following below conditions:

• decrease of the maximum coarseness of the feeding products of the mills at the first stage of comminuting from 25-30 to 10-15 mm;

• application at the crushing stages of the modern crushing-classifying equipment ensuring the rational conjunction of the crushers by the stages, automated control of the crushers operation with remote adjusting of unloading slits for obtain of the optimum coarseness of the crushed products before comminuting.

It has been carried out study and analysis of technology of the ore processing at the different GOKs of CIS. The study has shown that it is impossible to increase efficiency of disintegration at the crushing stages owing to the following reasons:

• more than 80% of the crushing and classifying equipment are depreciated and obsolete;

• used crushers are not suitable for rational conjunction and for operation in automated regime.

The specialists of "NPO "RIVS" JSC in cooperation with division "Mining Equipment" of "Uralmashzavod" JSC have worked out the more perfect technologies and equipment for realization of technologies.

The gyratory crushers are supplied with the means of automated control

of operation of the last ones with remote adjusting of unloading slit.

Fig. 1 shows the video frame of control of operation of the crusher KMD-3000T2-DP in automated regime. The crusher has been put into operation at the concentration factory "Erdenet" in 2002.

The kinds of control of operation of the crusher:

• loading of the ore into the crusher and maintenance of the optimum quantity of the ore (operation under the "cap");

• calculated unloading slit and necessary pulling of the slit after the established period of the operation;

• electric power, consumed by the main drive, and the current strength;



Fig. 1. Video frame of automated control of operation of the crusher KMD-3000T2-DP

• operation of the lubricating system with indication of the oil temperature at the entry to the crusher, in the cam unit, in the drive units, at the discharge with control of the oil level in the tank;

• correlation in the work with conjugated equipment.

Fig. 2–4 show the improved technological crushing schemes conformably to processing of the iron ores by the four-stages scheme; processing of the iron and copper-molybdenum ores by the three-stages scheme with circulating load for additional crushing of the abovescreen product; processing of the ores of ferrous and non-ferrous metals, chemical raw minerals with application of the new and improved crushing-classifying equipment.

It has to be noted that sometime the ores are characterized by heightened content of the moisture, ore mud, stowing materials and clay (Korshunovsky GOK, GMK "Noril'sky nickel", Uchalinsky GOK, Sibaysky GOK and so on). It leads to sticking of the bunkers, ore-flow passages, screening surfaces and crushing cavities of the crushers and causes the necessity to work with unloading slits of increased sizes. As a result coarseness of the final product increases up to 30-39 mm.









Fig. 2. Technological scheme of processing of the iron and copper-molybdenum ores and chemical raw minerals at the "Erdenet" GOK, Stoylensky GOK, Kostomukshsky GOK and ANOF-3

Fig. 4. Technological scheme of processing of the ores of ferrous and non-ferrous metals, chemical raw minerals at Leninogorsky GOK, GMK "Pechenganickel", ANOF-2, Zyrianovsky MCK, Gaysky GOK



Modernized technologies have been put into practice at CP (concentration plant) of the combine "Erdenet", at Stoylensky GOK, at the four cascades of the middle and fine crushing of Mikhaylovsky GOK, ANOF-2. It has been offered and examined technical and technical-commercial offers for GOKs "Mittal Steel Krivoy Rog" ("Krivorozshstal") and for Severny GOK.

Arrangement of the point of the extra-fine crushing after the common fine crushing is the prospective direction of further decrease of the coarseness of the crushed feeding product for mills. It has been constructed and put into practice recently the number of the machines: gyratory crushers-calibrators KMD-1750TK-D and KMD-2200T6K-D; press-rollers RP-120x80; centrifugal crushers of the type "Titan" D-160 and D-250. For realization of the direction it has been worked up the



Fig. 6. Technological scheme of additional crushing of the products of fine crushing at Zyrianovsky CP





Fig. 7. Technological scheme of preparing of the copper-molybdenum ore for processing (treatment) at the "Erdenet" GOK in prospect

7

number of technological schemes (in accordance with the technical targets of the enterprises) with obtain in the open cycle of the crushed product with the coarseness -9(-12) mm (fig. 5–7).

It has to be noted that decrease of the coarseness of feeding of the mills and increase of productivity of the last ones ensure perfecting of the process of comminuting. At the same time quality of the comminuted products increases owing to:

• application at the first stage of comminuting of the ball mills of the type MShC instead of MSC or MShR;

• transition to loading of the mills of the first stage with the balls 60 and 80 mm diameter instead of 100 and 120 mm;

• optimization of loading of the mills by the stages, including application at the second stage of the interchangeable mills with increased volume of the drum by 40-45% (it is reached by means of use of the segment bearings as a support for the drum).

The conception of the technical re-equipment of the ore-preparing facility at the combine "Erdenet" with increase of capacity is interesting.

It is recommended the mentioned below measures:

• removal of the rough crushing to the open-pit with application of DPU-1000 (with the crusher KKD-1350/160) in the block-modular unit instead of rough crushing in the crushing-transport department (DTO) (KKD-1200/150, 2 pieces) and in the section of the self-crushing (KSI) (SchDP-15x21, 1 piece);

• inclusion of the unit of fine crushing (with exclusion of circulating load) into DTO for additional crushing of the over-screen product (+10 mm) with usage of the gyratory crushers KMD-2200T6K-D (2 pieces) or press-rollers RP-120x80 (2 pieces); inclusion into KSI of the crushers WF-500 (2 pieces) for additional crush-

ing of the product +10 mm after the crushers MMPS-90x30 (2 pieces).

For all this it is going to decrease the nominal coarseness of feeding product for ball mills in the crushing-flotation section to 10-11 mm and in KSI — to 8-9 mm with increase of productivity of the ore processing from 25 (2007) to 30 million tons.

## Conclusions

1. Put into practice modernized technologies and technique of the ore preparing have the mentioned below advantages:

• coarseness of the crushed feeding product decreases to 10–15 mm in comparison with existing technologies;

• productivity of the crushing cycle and processing sections increases by 15–20%;

• power inputs of the ore preparing facility decreases by 15–20%;

• life of the lining of the drum mills of the first stage increase 1.3–1.4 times;

• consumption of the comminuting medium decreases by 16-19% owing to transition to the balls 80 and 60 mm diameter (instead of 120 and 100 mm);

• it has been optimized loading of the mills by the stages of comminuting, improved granulometric composition of comminuted product (for example, output of the class +0.16 mm with poor flotability decreases by 13-20%);

• cost of the concentrate decreased by 14-26%.

2. Capital expenses for technical re-equipment of the stages of crushing and comminuting are compensated within 1.5-2 years owing to decrease of operational costs.