

## ANALYSIS OF WORK CONDITIONS OF COKE-PITCH BLOCK EQUIPMENT

In this article conditions working of coke-pitch block equipment are considered. It is distinguished principal factors, influencing the work resource of this equipment. Are main aspects of comprehensive system approach for this type of equipment are offered.

One of the required products of chemical-recovery productions is product of tar-distilling works coal-tar asphalt and obtaining production of heat recycling in the thermal aggregates (chamber ovens, cube installations), which is used for the following purposes:

- for production pitch (ash content not more 0,25-0.50%) a pitch binding, used to obtain anode mass for manufacturing aluminum, electrode and core wire;
- fabrication, production building materials, tap hole clay;
- graphitized products (ware), carbon graphitized blocks, for production patch coal fuel, soft-grade roofing, pitch plastic, lacquer for protection pipe corrosion prevention.

Working environment State Standard 1038-75[1] has a complex no uniform structure of carbons and chemical composition. According to above mentioned SS, coal-tar asphalt can be of two types: intermediate and high-temperature distinguished with temperature of softening. It is coal-tar asphalt (yield-mass 50-60%). It is a uniform thermoplastic substance of black color with shiny conchoidal fracture. Elementary composition is(%): 92-93 C, 4,3-4,7 H, 0,3-0,85 S, 1,7-1,8 N, 0,8-1,0 O. Density 1,2 kg/m<sup>3</sup>, ash content 0,2-0,4%[2] It doesn't have certain temperature of melting and solidification. During thermal process agents undergoes phase transition from liquid to solid.

Coal-tar asphalt recycling is performed by different manufacturing schemes and corresponding in a variety of instrument execution. One of the most common methods is it reprocessing in chamber coke-pitch oven. The process of recycling in coke-pitch ovens has definite similar characteristic: temperature of coking, mode off-load and quenching. But the coke-pitch ovens are quite different from the coke

ovens, which are assigned by property of the obtaining product of coke-pitch or pitch.[3]

The most significant difference distinctions are:

1. Number of chamber in battery: from 5 to 12 subject to configurations;
2. Different capacity of the chamber from 11,5m<sup>3</sup> to 17 m<sup>3</sup>, corresponding amount of loading of the chamber;
3. Variant constructions of heating (coke of system of Shtil, Koppers, Giprokoks)
4. Method of loading fractional or continues 3-5 hours;
5. Means of preliminary coal-tar asphalt preparation for coking operation.

It should be noted that one of the important moment of operation coking of coal-tar asphalt, moved in liquid species at temperature of softening 140-150 °C, preheated for approximately 300-320°C.

Let consider to be the main factors, which are influenced the service life of coke-pitch ovens.

Phase transition from liquid phase coal-tar asphalt to solid phase coke-pitch results in difficult heavy-duty conditions of operation. The loading of liquid coal-tar asphalt in coking chamber leads to thermal shock of chamber heating walls. According to this thermal considerable stresses arises for every loading. The temperature of chamber heating walls is from 1000°C to 1260°C; of the moment of loading the temperature of chamber heating walls is dropped to 700°C. The chamber heating walls is cooled of a considerable depth in the direction of flues heating, reverberating heat for heating loading and distillation pitch.

The chamber heating walls are proved to try hydrostatic pressure of loading coal-tar asphalt and pressure from unloading coke-pitch.

High loads on the teardown filled oven the side of maintain coke machinery. Unloading of coke-pitch from the oven and instrument service passes through significant stresses in the brickwork:

- 200-250 kN from unloading coke in start moment of displacement;
- 100-210 kN from removal of door.

The coal-tar asphalt feting is conducted in liquid condition in coking chambers. The major influence on reliable performance and distribution to chambers

coking pitch among the chambers is provided efficiency of special piping accessories. They operate with heavy-duty - hostile viscous agent at significant temperature, high corrosiveness working agent and surround environments, considerable volume of production, continuity, complexity and variety composition of agent and environment, which is toxic, poison and carcinogenic. By the degree of influence on human organism pitch is rated as II class of danger by SS 12.1.007-76 [4]. For the process intensification higher temperature and pressure are used. In addition to the above mentioned equipment demands the system approach. On the basis of systems concept it is possible to execute the analysis of work equipment. It will allow to evaluate service life of the equipment. [5]

Renders service life the coke-pitch ovens is in interval from 2,5 to 10 years. But qualitative and timely maintenance increase service life approximate by twice. Visible destruction at performing of brickwork for this type of ovens has already begun after 6-8 months of operating. Therefore for maintenance grade technical state, it is necessary to repair work equipment. Maintenance costs in aggregate amount to conduct raise prime of cost stock-produced produce.

All these factors indicate the complexity of operation conditions of equipment for processing coke-pitch, and work at higher temperatures, large content in-process material, continuity workflow, liability of banding fill line and tube fittings which are on coke-pitch ovens; temperature difference from recycling pitch, considerable loads on brickwork – it is predestine complex approach for this types of production. Complex or system approach involves the following aspects:

- 1) Stocktaking characteristics of working are and its influence agent on equipment, temperature of phase transition, adhesive behavior, execution of chemical and structural analysis;

- 2) Necessity of execution of timely and qualitative diagnostic, nondestructive method of checkout. By means of the modern instruments it can be done with different results of continuous processing. If the diagnostic is conducted with a certain regularity, it will be able to obtain velocity of behavior ungraded processes. For example, velocity of corrosion, formation and growth deposition, stress strain state, distribution of temperatures of the most responsible places. For the thermal aggregate it is possible to measure the following characteristics: temperature of

heating partition, growth of ovens size, temperature stress in the supply collectors, thickness residual measuring of tubing and metal ware. In case of carrying out measuring of different characteristic it is possible to account complex character of influence on the equipment. Characteristic, which is being measured, is probabilistic quantity with a certain interval and confidential probability.[6] The combination of probability parameters, entered in calculation formulas, would be analytical model.[7] The analytical model will allow to evaluate the passage from one to another state with defined probability.

3) Enhancement of level of operation well-timed execution of maintenance and restoration, maintenance of parameter of engineering process, level of proficiency service staff.

Equipment of coke-pitch block requires comprehensive systems approach, which would allow change of state as a result of variation analytical model with specified probability. This will allow to create probabilistic mathematic model. Probabilistic model will give more fundamental predictions about resources efficiency of equipment. According to adoption further decisions will be more correct and permit to increase service life, raise economic efficiency of its operation.

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