VI. АКТУАЛЬНІ ПИТАННЯ СУЧАСНИХ ТЕХНОЛОГІЙ ВИРОБНИЦТВА ТА НАДАННЯ ПОСЛУГ

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ANALYSIS OF THE REASONS FOR THE REDUCED ACTIVITY OF THE VANADIUM CATALYST IN THE PRODUCTION OF SULFURIC ACID

Solid impurities (ash) in the form of dust in the production of sulfuric acid negatively affect the operation of the first layer of vanadium catalyst for the oxidation of SO_2 to SO_3, causing a rapid increase in the hydraulic resistance of the catalyst.

This ash consists of calcium compounds in the form of CaO and iron in the form of sulfate salts, such as $FeSO_4$ and $Fe_2(SO_4)_3$. To eliminate the consequences of the presence of such impurities, the most effective is the use of sedimentation filters and liquid sulfur filters, which are installed in the liquid sulfur supply system at the inlet to the sulfur combustion furnace [1; 2; 3; 4].

The purpose of this work was to study the occurrence of such impurities for the subsequent adoption of measures to eliminate them.

The main question was to determine the sources of impurities in the top layer of the vanadium catalyst. Having analyzed the raw materials used for combustion, as well as the methods of transportation and combustion of sulfur, we can assume the following options for the appearance of impurities: 1) raw materials; 2) products of destruction of the lining of a sulfur combustion furnace and the cement mortar used to bind this lining or introduced into the furnace.

Since sulfuric acid plants usually use high-quality sulfur with a low carbon content (DSTU 2181-93) as raw materials, impurities in the raw materials can only appear at the transportation stage. Since when transporting raw materials, open

gondola cars are usually used, the hatches of which are secured with iron wire, the cracks are sealed with boards and plugged with paper.

However, as a raw material it is possible to use sulfur used in acid treatment, carried out in some industries of other countries (the content of sulfuric acid in the sulfur obtained in this way is up to 0.1 %, and the content of chloride ions is up to 0.01-0. 04%.). Which leads to equipment corrosion.

Also, one of the options for the occurrence of calcium compounds in raw materials is the addition of lime (0.15 kg/t of sulfur) to neutralize acidic impurities that are separated from molten sulfur during its settling and prevent corrosion [5; 6; 7].

Thermal insulation material of equipment for burning sulfur can also be a source of impurities, since the clay used for installing refractory fireclay bricks contains 10 % iron oxides Fe_2O_3 and FeO_3, and up to 25% calcium oxide CaO (DSTU B V.2.7-60-97).

A feature of the technology, in which it was recommended to place a so-called substrate on the lattice of the catalyst layer, which usually consisted of pieces of quartz, which was necessary to maintain the heat capacity of the catalyst, is also a possible source of impurities.

Another reason for the appearance of impurities is pyrite FeS_2, which is formed at the initial stage of the sulfur melt, as well as in the stagnant zones of the furnace due to the contact of sulfur with metal parts of the equipment. Also, iron compounds can form as a result of corrosion of metal parts of the equipment of the furnace and waste heat boiler, and reach the catalyst layer through the pipeline.

To solve the problem of the appearance of impurities in the layers of vanadium catalysts for the production of sulfuric acid, the following measures must be taken:

- eliminate the possibility of contamination of lump sulfur with dust, lime and corrosion products by properly organizing its storage in warehouses;
- improve the stage of filtration of liquid sulfur, eliminating impurities that may contain lime;
- burn sulfur in a furnace in a strictly defined temperature range of 500 ^{0}C – 1200 ^{0}C to eliminate the possibility of the formation of acid-forming oxides SO_3 and NO_2, which can lead to equipment corrosion;
- thorough cleaning of the internal surface of the furnace from dust, corrosion products and dirt before each start-up of the system;
- install filters at the outlet of reaction gases after the waste heat boiler;
- carefully follow the rules for laying and launching vanadium catalysts, especially the first layer;
- load the upper part of the catalyst as the first layer, either an annular tubular catalyst with a diameter of 10–15 mm, or ceramic refractory balls onto a BASF sample;
- develop refractory elements (brick and cement) exclusively for the sulfuric acid industry for lining, which do not contain calcium and iron compounds.

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