INFLUENCE OF THERMAL ACTIVATION OF CHALCOPYRITE ON ACTIVITY AND SELECTIVITY OF CATALYTIC DECOMPOSITION OF ISOPROPYL ALCOHOL

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The decomposition of isopropyl alcohol on natural chalcopyrite was studied by the microcatalytic pulse method in the region 473 - 673 K. The activity and selectivity of the catalyst was confronted with the temperature of its thermal activation. The apparent activation energies of decomposition were calculated for chalcopyrite activated in argon atmosphere at temperatures of 673, 773, and 873 K. The values of activation energy thus obtained are 61, 38, and 44 kJ mol\(^{-1}\). The liberation of sulfur from the lattice of chalcopyrite caused by thermal activation gives preference to dehydration over dehydrogenation at lower temperatures. The proportion of hydrogen and acetone in reaction products increases with temperature.

Разложение изопропанола на природном халкопирите исследовали на импульсной микрокаталитической установке в интервале температур 473-673 К. Кажущиеся энергии активации разложения в случае халкопирита, активированного в аргоне при 673, 773 и 873 К, равны 61, 38 и 44 кДж/моль, соответственно. Выделение серы из матрицы халкопирита при термической активации приводит к доминированию дегидратации над дегидрогенизацией при низких температурах. Доля водорода к ацетону в продуктах реакции увеличивается с температурой.
INTRODUCTION

The decomposition of alcohols belongs to the most frequently studied model reactions in heterogeneous catalysis. Besides commonly used catalysts of the oxidic type, the catalysts on the base of sulfides are also used. The sulfidic catalysts applied at higher temperatures exhibit a mass decrease which is due to elimination of sulfur from the lattice. For instance, dissociation of MoS$_3$ and the formation of hexagonal MoS$_2$ on heating in the 673 - 1273 K range was observed [1].

In our preceding study we investigated the decomposition of isopropyl alcohol on natural chalcopyrite CuFeS$_2$ without any preceding treatment of the catalyst [2]. The aim of this study has been to investigate the influence of thermal activation of chalcopyrite on the course of the catalytic decomposition of isopropyl alcohol.

EXPERIMENTAL

Apparatus. For studying the decomposition of isopropyl alcohol we used an apparatus working in the regime of the microcatalytic pulse method [2]. The results published in this paper were obtained under the following conditions. Grain size of the catalyst 0.8 - 1.0 mm, mass of the catalyst 2 g, magnitude of the pulse of isopropyl alcohol 3 μl, reproducibility of dosage ± 4 %.

X-ray phase analysis. The diffractograms of samples were taken with an instrument DRON 2.0 (Soviet Union) under these conditions: CuKα - radiation, 30 kV, 20 mA, rate of goniometer advance 16.67x10$^{-3}$ s$^{-1}$.

Specific surface. The specific surface was determined by the BET method [3] using benzene as adsorbate.

Catalysts. Natural chalcopyrite CuFeS$_2$ (Slovinky, Czechoslovakia) was used as catalyst. Besides chalcopyrite, an admixture of quartz was also identified by X-ray phase analysis (ASTM 9-423 and ASTM 5-0490). The catalyst was activated in a