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Thermogravimetric investigation and selection of catalyst of coal hydrogenation

Abstract: Thermo gravimetric study of coal in the presence of polymers showed that availability of high asphalt-resinous components – asphaltenes and resins benzene within the temperature of 360 – 443°C in the content was reduced. The optimum catalytics of coal hydrogenation is the compositions on the basis of Pd / C, at which there was the greatest absorption of hydrogen and Co / C, where the hydrogenation rate was maximum.

Key words: coal, polymers, hydrogenation, paste-head, Balkhash concentrate catalysts.

Introduction

The efficiency and effectiveness of performance of coal hydrogenation process at an industrial environment is carried out with great difficulties. Except the importance of features and structure of the original coal, a macro kinetic choice of pressure's modes, temperature and catalysts also has a great value.

The aim of majority processes of coal's chemical recycling (with the exception of the production of carbon materials) is its conversion into low molecular organic products, with a quite homogeneous composition. The conversion of coal into the more organic compounds can be achieved under the heat treatment and exposure to different reagents [1, 2]. During the heating process the weak aliphatic chains, which bind condensed aromatic structures, are usually disrupted primarily. The disruption of carbon-oxygen bonds has a decisive contribution during the process of depolymerization of brown coal.

Management of the reactions of disruption of certain bonds can be done by selective introduction of metal catalysts into the functional groups of the coal substance. For example, the temperature of aliphatic bond's disruption, which connects two aromatic fragments, reduces if a divalent metal cation replaces the protons of two neighbour phenolic groups.

The main disadvantages of known techniques of chemical recycling of coal compared with the technologies of oil refining and petrochemical are a relatively low productivity and stringent conditions for their implementation (high temperature and pres-

sure). To eliminate these shortcomings in the coal recycling, there is a wide spread usage of catalysts and new catalytic processes, which allows to obtain variety products from coal with a fuel and chemical features [3-8].

Experimental part

The experiment was conducted as following: 5 g of a mixture of dry brown coal from Karazhirskyi field was subjected to mechanical activation with a particle size of less than 0.1 mm, then a polyethylene with a particle size less than 0.5 mm, which was taken in an amount of from 10 to 70 wt.% by weight of a mixture of coal – polyethylene, were placed in a steel autoclave rotary with a volume of 0.5 l. The substances as Pd, Co, Mo and Fe were added as catalysts.

The autoclave was closed and the hydrogen was supplied until achieving a pressure of 5.0 MPa. The autoclave was heated to 430°C with continuous stirring, then it was kept at this temperature during 60 minutes, while the pressure in the autoclave was 6.0 MPa. After that, the autoclave was cooled and the gaseous products were separated. Then, the fraction, which was boiling up to 200°C, was separated from autoclave, and it was freeze-dried in a nitrogen trap. The solid product was separated and filtered.

Thermogravimetric studies were performed under the following experimental conditions: weight of the sample – (0.3 ± 0.03 g); analytical grinding; ceramic crucible with a lid, height of which is 15 mm and diameter 5 mm. Processing of the derivatograms in-