CLAY MINERALS MODIFIED WITH IRON(3+) NITRATE FOR ULTRA-DEEP DESULFURIZARION OF TRASPORTATION FUELS

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Removal of sulfur-containing compounds from liquid fuels is currently achieved by hydrodesulfurization. However the method is not efficient enough for deep desulfurization (< 50 ppm), because benzothiophene and dibenzothiophene (DBT) derivates, especially containing functional groups (i.e. 4,6-dimethyl-dibenzothiophene (4,6-DM-DBT)) are highly resistant to the method. These problems can be solved using the method based on selective adsorption of sulfur-containing compounds by special adsorbents. Among a variety of investigated porous materials nanocomposites prepared by incorporating of fine particles of metal oxides into interlayer space of montmorillonite (MM) has been intensively studied.

In the paper the results of testing the possibility of removing DBT and 4,6-DM-DBT from their model solutions in decane and heptane with use of native, acid activated and impregnated with iron nitrate MM samples are presented.

It is shown that adsorption of DBT and 4,6-DM-DBT on the native and modified MM samples proceeds through the various mechanisms and results in various products of decomposition both on the surface of the MM samples and in solution. Both adsorption and partial transformation of 4,6-DM-DBT molecules are observed for the initial MM samples, but modification of the clays with iron nitrate increases in a large extent the amount of adsorbed species due to coordination of 4,6-DM-

DBT molecules with iron ions and subsequent oxidation by nitro-groups.

Transformations of the adsorbed compounds occur through reactions of hydrogenolysis and selective oxidation of sulfur. Oxidation of the adsorbed molecules causes their transformation up to surface sulfones and/or sulfoxides and in less extent to sulfates. The products of the transformation adsorb on the MM samples as well. Much more intensive adsorption and transformation of sulfur-containing organic molecules occur in decane solutions as compared with solutions in heptane.

Interactions of sulfur-containing compounds with modified clay minerals in model fuel solutions run essentially fast in condition of simultaneous intensive mixing of the solutions with the MM samples. For example, 20 minutes contact duration is enough for the complete removal of 4,6-DM=DBT from solutions in decane.

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