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Decomposition of hydrogen sulfide containing gases on kaolinites modified by iron

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In this paper the application of kaolinite clays modified by iron as the catalysts in hydrogen sulfide photocatalytic decomposition under UV irradiation for hydrogen production is considered. According to elemental analysis of kaolinites (KE and KS) are chosen as the matrix, they contains 4.8 (KE) and 6% (KS) Fe_2O_3 and 0.4-0.6% TiO^2 for KE and KS, respectively. According to XRD and IR spectroscopy fine fractions of kaolinites present as contaminants of montmorillonite and other minerals (cristobalite, muscovite). Modification of kaolinites by iron is carried by mono- and binuclear hydroxocomplexes. The content of iron was varied from 2.5 to 5.0 mmol Fe^{3+}/g of clay.

The process was studied in the quartz reactor at the temperature of 40-80^{0}C. The source of UV radiation was a mercury UV lamp power of 100 watts. Catalysts was treated preliminary in the stream of H_2S at 500^{0}C for 2 hour. The catalysts were tested by methods: electron microprobe analysis («Superprobe-733», JEOL), BET by low temperature nitrogen adsorption. According to BET decreasing of the specific surface area from 97.9 to 161.5m^2/g with increasing concentrations of iron in the modifying solution is observed for FeHKE-composites, and for FeHKS-composites from 143.7 to 69.4 m^2/g. The pore volume is reduced from 0.251 to 0.117cm^3/g for FeHKE, and for FeHKS from 0.142 to 0.096cm3/g. 100% conversion of hydrogen sulfide is observed on all samples for 3-6% H_2S-containing gases during long time without activity decreasing at space velocity up to 525 $hour^{-1}$. Increasing of the concentration of H_2S up to 70% leads to the decreasing of the time of total decomposition of hydrogen sulfide. The specific catalytic activity of Fe(2.5)HKE and Fe(2.5)HKS are 0.07-0.09ml/min*m2, and for Fe(5.0)HKE and Fe(5.0) HKS-0.09 and 0.1ml/ min*m2, respectively.

It is concluded that the samples of kaolinites modified by iron may be used in the H_2S decomposition into hydrogen and sulfur in case of gaseous mixtures with low concentration of hydrogen sulfide. Increasing of the introduced iron concentration up to 5.0 mmolFe^{3+}/g of clay reduces specific surface and volume of pore. The specific catalytic activity of samples in the decomposition of gas mixtures with high concentration of H_2S practically is unchanged.

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