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# P116 Supported nanosized block catalysts in oxidation of light alkanes into hydrogen-containing compositions

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Results of the study the activity of supported block catalysts in hydrocarbon mixtures, which are close to real for obtaining hydrogen-containing compositions, are presented. The block ceramic catalyst having supported active phase consisting of 1% (Pt+Ru)/2% Ce/(θ+α)-$Al_2O_3$, was prepared for the research. Microspherical 1% Pt-Ru/2% Ce/(θ+α)-$Al_2O_3$ catalyst was supported on the block ceramic honeycomb carrier (fragments of blocks d = 10 mm; h = 20 mm, the channel size 1.0 × 1.0 mm, wall thickness 0.5 mm). Layering of the active phase of catalyst with binder on the blocks in several steps is the essence of process. Tests of the ceramic block catalysts in oxidation of $CH_4$ were conducted in flow apparatus at atmospheric pressure in a quartz reactor with internal diameter of 0.025 m. The prepared catalyst block is wrapped in fiberglass and placed in a reactor. Initial reaction mixture was introduced at varying the ratio of reaction gases $CH_4$ and $O_2$ in a mixture from 1 : 1 to 4 : 1 and gradually increasing the temperature from 700 to 875°C and volume rate from 1000 to 10000 $h^{-1}$.

The process of oxidative conversion of hydrocarbon mixtures which are close to real while gradually increasing the reaction temperature from 700 to 875°C was investigated. Increase of methane conversion from 28 to 48% is observed with the growth of temperature. The amount of the produced $H_2$ increases from 33% to 84% at 850°C and again decreases to 70.2% at 875°C. A small amount of CO is formed at a temperature 700°C which increases with increasing temperature from 0.6 to 40.5%. Formation of $C_2H_4$ is observed at a reaction temperature 750°C in an amount of 13.0% and with the growth of temperature is lowered to 4%. Thus, the temperature 850°C is optimal for the formation of hydrogen, and 875°C and 750°C - for CO and $C_2H_4$, respectively. Effect of space velocity on direction of oxidative conversion of hydrocarbon mixture, which is close to the real, at variation of space velocity from 1000 to 10000 $h^{-1}$ was studied. It was found that the hydrogen yield was 40.5% at 1000 h -1. Amount thereof increased to 84.0% at 5000 $h^{-1}$ and then reduced to 45.1% with increasing space velocity up to 10,000 $h^{-1}$. The same dependence is observed for the formation of CO and ethylene. The amount of CO is increased from 10.5% to 38.0% and ethylene - from 7.8% to 13.0% at 5000 $h^{-1}$. Product yield gradually decreases with further increase in space velocity to 10000 $h^{-1}$. Increasing the space velocity from 1000 $h^{-1}$ to 5000 $h^{-1}$ positively effects on the conversion of initial mixture to desired products. 5000 $h^{-1}$ is optimal space velocity for the formation of desired products. Thus, optimum ratios of main gases in the reaction mixture were also determined.

Thus, optimization of technological modes of oxidative conversion of hydrocarbon mixture was carried out. Effect of varying the reaction temperature, space velocity and ratio of gases for selective production of desired products was investigated. The temperature ranges of 725-875°C and space velocity 5000 $h^{-1}$ are optimal process parameters to produce hydrogen compositions. It is determined that the oxidative conversion of methane to hydrogen-containing mixture is carried out at the optimum ratio of components $CH_4 : O_2 = 2 : 1$ at a concentration of gases (50% : 25%), respectively.

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