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CATALYSTS FOR SELECTIVE DECOMPOSITION OF METHANE

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The catalytic conversion of natural gas into motor fuel component, the raw material for the petrochemical industry and organic synthesis for over 20 years, the subject of intensive research are driven by the problem of reducing the resources of hydrocarbons of petroleum origin. Of particular interest in this respect are the partial oxidation of methane to synthesis gas and an oxidizing dimerization of methane to C_2 hydrocarbons. Syngas is a feedstock for the oxygenates production (methanol, dimethyl ether, etc.) and for producing liquid and solid hydrocarbons by the Fischer-Tropsch process [1]. C_2-C_4 olefins are of considerable interest as a raw material for industrial organic synthesis, which are widely used for the preparation of polymeric materials, plastics, alcohols, esters, carboxylic acids, components of motor fuels etc. Production of ethylene ranked first in terms of production among basic petrochemicals [2]. For countries with large reserves of cheap natural gas, the practical implementation of these processes today seems economically justified. Therefore, the creation of highly efficient, selective and stable catalysts for processing light hydrocarbons to produce valuable products of petrochemical synthesis is an important practical and strategic goal [3].

We report here on the activity of silicon and aluminum oxides, and a new series of catalysts on the base of $H_8[Si(W_2O_7)_6]\ nH_2O$ and $NiO\text{-}La_2O_3$, supported on SiO_2 and Al_2O_3 to be tested in partial oxidation processes and oxidative dimerization of methane. Experiments to test the catalytic activity of the catalysts developed carried out on an automated flow set to 600-850°C temperature range, at atmospheric pressure. The results of the study showed that changing the composition of the catalyst and the conditions of the oxidation of methane can obtain valuable products such as synthesis gas, and ethylene. Supporting of tungsten heteropolyacid on alumina leads to improved selectivity on ethylene. Using as active phases of nickel and lanthanum oxides supported on alumina results in a mixture of hydrogen and carbon monoxide (synthesis gas). Introduction of the lanthanum oxide into the Ni / Al_2O_3 catalyst increases the textural characteristics of the catalyst and enhances catalyst stability to coke deposition. For $Ni\text{-}La / Al_2O_3$ catalyst is observed the highest catalytic activity in the reaction of partial oxidation of methane with oxygen. The conversion of methane was 95%, the yield of hydrogen and carbon monoxide 46 and 40%, respectively.

References:

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