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Catalytic effect of nanosized catalysts in the process of hydrogenating acetylene to ethylene

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The paper presents the investigation results on carriers and nanosized nickel, cobalt containing catalysts deposited on different carriers. To study the catalytic action of nanoscale catalysts, at the initial stage, active carriers: Zeolite 3A and Al_2O_3 were chosen. Acetylene and hydrogen in different ratios (1:1, 1:2, 1:3) (C_2H_2:H_2) were used as initial feedstock. The catalytic activity of carriers was studied using automated flow catalytic installation in acetylene hydrogenation reactions on nanoscaled Ni, Co containing catalysts and carriers at a pressure of 5 atm is studied. The actions of carriers and nanosized catalysts during hydrogenation reaction of acetylene to ethylene at low temperatures in the range from 50-100 °C are studied. At a ratio of C_2H_2:H_2 being equal to (1:2) at 80°C the carrier-aluminum oxide exhibits activity and conversion of acetylene makes up 70%, when using zeolite 3A, it is 63%. When the temperature rises to 120°C, the activity of aluminum decreases and conversion is 53%, but zeolite exhibits activity at high temperatures and at a temperature of 120°C, conversion of acetylene reaches to 73.5%. It is shown that with an increase in hydrogen ratio, the yield of ethylene increases from 5% to 10.7% on the catalyst 5% Ni/3A. Also, in the reaction of acetylene hydrogenation there are no byproducts. For this process, the optimum reaction temperature is 80°C, feedstock ratio (1:3) is positive, where the yield of ethylene 5% Co/3A catalyst increased to 16.7%. The effect of the content of cobalt from 1% to 10% is studied. The results of the study have shown that the optimum content of cobalt is 5%. In hydrogenation reaction of acetylene on the catalyst 1% CoO/3A, the yield of the target product was 10.96%, on the catalyst 5% CoO/3A the yield of ethylene was 16.7% with an increase in the content of cobalt from 5% to 10% the yield of ethylene decreased from 16.7% to 4.5%. Thus, the optimum content of cobalt is 5% for the hydrogenation process of acetylene on zeolite. The morphology of the surface of cobalt-containing catalysts on zeolite was studied by the electron microscopy method. In the composition of catalysts there are particles of a round shape with the nanosizes of 24-27 nm, the sizes of particles change according to the composition of catalyst in the range from 24 to 100 nm. It is seen that the particles are distributed uniformly on the surface of the catalyst. Also, it can be seen that the catalysts operate actively and do not lose activity in the reaction of hydrogenating acetylene to ethylene. The elemental composition spectra of 5% CoO/3A catalyst show that on the surface of granule intensive spectra referring to cobalt are determined granule. This means that distribution of the active phase of cobalt occurs at the outer surface of zeolite 3A. The composition and method of preparing cobalt and nickel catalysts deposited on aluminium oxide for hydrogenating acetylene to ethylene were developed. Thus, the obtained results show that aluminium oxide and zeolite 3A can serve as carriers of catalysts in hydrogenation reactions of acetylene. Conversion of acetylene increases when modifying zeolite with 5% cobalt in an automated flow catalytic installation under the pressure of 5 atm at a temperature of 80°C. Thus, the cobalt-containing catalyst deposited on the carrier substrate 3A exhibits catalytic activity during hydrogenation of acetylene to ethylene.

Biography

Tanirbergenova Sandugash Kudaibergenovna has experience in the implementation of innovative projects. She is responsible for the execution of programmers and projects of the MES for a number of years and was engaged in practical and theoretical research in the field of chemical physics of processes of synthesis of carbon materials from waste natural and technogenic raw materials in the field of hydrocarbon processing.

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