Effect of ultrasonic treatment on the properties of skeletal Ni catalysts

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1. Introduction

The use of ultrasound in chemistry, particularly in catalysis is one of the most successful examples of the use of alternative methods of physical effects on the reaction system. Nearly all catalytic processes can be classified as reactions in non-aqueous systems, since the main solvent or reagent can be an organic substance, although water may participate in an aqueous system. Furthermore, such a classification of catalytic processes covers the whole range of sonochemical reactions consisting new approaches: aqueous and organicsonochemistry, homogeneous and heterogeneous.

However, fundamental question about the detailed mechanism of catalysis in an ultrasonic field remains open. The possibilities of using ultrasonic waves for preparation of catalysts and activation, regeneration of various catalytic systems and for catalytic reactions is very attractive and makes it technologically perspective [1-2].

The effects of ultrasound on the formation of the catalyst can have far-reaching consequences; changes in the methods of crystallization, dispersions, and surface properties. The most heavily studied sonochemical system of hydrogenation include nickel catalysts and has a long history of development [3].

This paper studies the influence of ultrasound on the physical and chemical properties, morphology and phase composition of the catalyst.

2. Experimental

The object of study was a Ni Raney catalyst obtained from the alloy -51.1% Ni, Al - 46,9%, Fe - 0.075%, Cr - 0.893%, Ti - 0.914%. For the preparation of skeletal nickel catalyst by a complete leaching, the alloy was pulverized in a mortar, and sieved. Then a certain fraction of powder weighing 1 g was treated in a Kjeldahl flask with 20% sodium hydroxide solution while heating in a water bath for 2 hours, then drained and obtained alkali powder was washed with distilled water by decantation. After this, freshly prepared catalyst was subjected to an ultrasonic treatment. Sonication was carried out in an ultrasonic bath UZV-3/100 FST-44. The frequency of ultrasonic treatment was 60-150 Hz. Treatment temperature varied from 25 ° C to 65 ° C, time - 30 minutes. Physicochemical properties of skeletal Ni catalyst was examined by X-ray diffraction on a DRON-3M digitally using copper radiation and scanning electron microscopy instrument Quanta 3D-200i (FEI Company, USA).

3. Resultsanddiscussion

X-ray analysisof skeletal nickel catalyst before and after ultrasonic treatment was conducted (Table 1). The analysis shows that main phase nickel was detected in the initial catalyst skeletal Ni. This is confirmed by the fact that the diffraction pattern has a great background, typical for X-ray phase nickel on copper radiation. One unidentified diffraction line (d = 1,4870 Å) with very small crystallite size.presentson a radiographs. The crystal lattice parameter of nickel is equal to a = 3,5352 Å. Nickel crystallite size is L = 40 Å.

Sonication of skeletal Ni catalyst leads to the formation of additional phases, but the final products after sonication radiographically identical, main phase remains unchanged. The weak intensity of diffraction lines