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Synthesis and Properties of Bicomponent Complex Systems Based on Organic Acid and Polyoxometalate Compound

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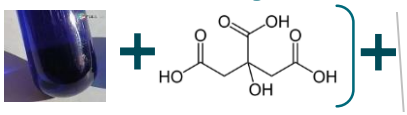
Introduction

Every year the need for catalysts for the processing of heavy raw materials increases. In particular, these include systems based on transition metals (Mo, W, Co, Ni...). Catalysts based on them increase the depth of processing and make it possible to involve heavier raw materials in the process. Thus, the development of new catalytic systems is an urgent task of our time. One of the approaches is to obtain new active components. One of the promising reagents is molybdenum blue - a mixture of non-stoichiometric oxides in the oxidation state +5-+6. However, a small number of studies on this topic attract the attention of scientific groups. The purpose of this work was to obtain deposited Mo-containing aluminum oxide systems and study their properties using a set of modern physicochemical methods.

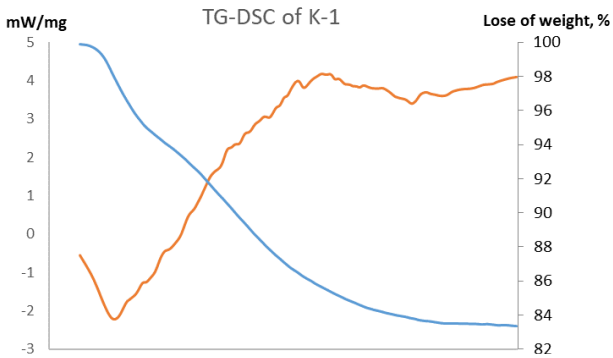
Synthesis

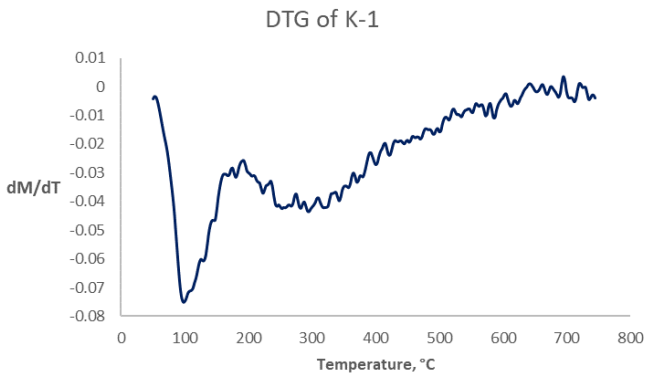


Sample	Heat treatment temperature, °C
K – 1	25
K – 2	100
K – 3	300
K – 4	400

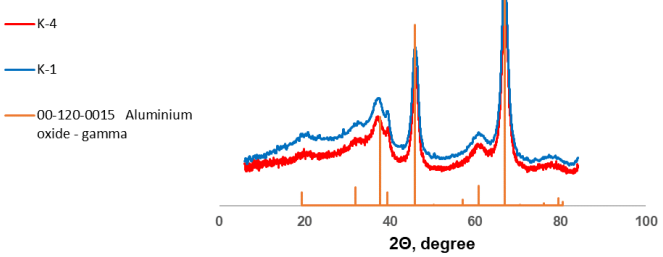
The synthesis was carried out by the standard method of impregnation in an excess of an impregnation solution, g-Al_2O_3 acted as a carrier, the impregnation solution consisted of an alcohol solution of molybdenum blue and citric acid (as a chelating agent)

Characterization of the materials

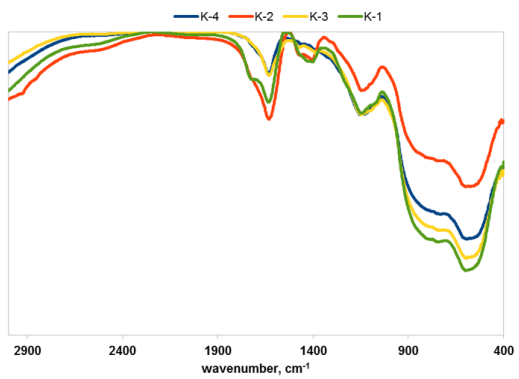




According to the results of TG analysis, the total mass loss of the sample was slightly more than 17%, which indicates its sufficient thermal stability. Weight loss in the range of 100-200 °C is characterized by the removal of adsorbed water, a further decrease in weight in the range of 200-300 °C is characterized by the decomposition of molybdenum citrate complexes formed by interaction with citric acid.



The phase composition obtained by XRD is represented by the support phase (g-al2O3), the absence of oxide phases of molybdenum can be explained by its lower concentration, as well as a high degree of dispersion.



. It can be seen from the figure that thermal treatment does not significantly affect the overall profile of the spectra. Broad absorption bands (absorption bands) in the range of 500-900 cm^{-1} refer to structural fragments of Al-O-Al and Al-O. In this region, there is a high chance of overlap with the corresponding oxide molybdenum structures in the regions of 560-580 and 720-790 cm^{-1}. The band of medium intensity in the region of 1140 cm^{-1} characterizes the vibrations of the citrate skeleton, and in the region of 1640 cm^{-1}, apparently, it refers to physically sorbed water.

Conclusion

A series of bicomponent systems based on citric acid and molybdenum blue obtained by the method of precursor mechanical activation (MoS_2) were synthesized. The thermal properties, as well as the chemical and phase composition of these systems, have been studied. It is shown that molybdenum blue obtained by a mechanochemical method can act as a molybdenum-containing component in the synthesis of catalytic systems.

References

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