Catalytic activity study of lanthanum manganite, doped by silver and barium.

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Hydrogen fuel cells are very sensitive to admixtures in incoming gas. Industrially produced from natural gas hydrogen contains 0.5-2% of CO admixture. Thus, actual problem for modern industry is a purification of hydrogen from traces of CO. The simplest and the most effective method is selective catalytic oxidation of CO in the hydrogen atmosphere. As it is known from the literature, lanthanum manganite is active catalyst in CO oxidation in air [1]. Thus we decided to study application ability of lanthanum manganite as catalyst for selective CO oxidation in hydrogen atmosphere.

Also an actual problem is catalytic processing of natural gas, which consist of 96-99% of methane. Thus, important objective is the catalytic development of methane i.e. conversion to synthesis gas and complex hydrocarbons. Alkaline-earth elements oxides, rare-earth elements oxides and in manganese oxide have high catalytic activity in methane oxidizing [2]. Thus we decided to study catalytic activity of lanthanum manganite, doped by barium and silver, in this reaction.

In addition we have studied the catalytic activity of lanthanum manganite, doped by low (0.3%) amount of silver, in reaction of selective benzene to phenol oxidation. At present, major way of phenol synthesis is benzene oxidation. Thus elaboration of most active and selective catalyst of this conversion is an actual problem. The most selective catalysts in this reaction are catalysts with low amount of active centers, when active centers are practically isolated from each other [3]. Therefore we decided to study activity of sample with low amount of silver.

Samples of La₁₋ₓAgₓMnO₃⁺ (x=0, 0.2; y = 0 ÷ 0.3) and La₁₋ₓBaₓMnO₃ (x = 0 ÷ 0.2) were synthesized using the method of impregnation and combustion of ashless filters. La₁₋ₓAgₓMnO₃⁺ samples were synthesized at temperature 700°C in oxygen atmosphere, La₁₋ₓBaₓMnO₃ samples – 1200°C in air. Phase composition of samples was established by X-Ray diffraction. All samples, expect La₀.₇Ag₀.₃MnO₃⁺ and La₀.₇MnO₃⁺ are single-phase.

We found, that higher the content of silver the lower selectivity in reaction of CO oxidation in hydrogen atmosphere. This effect appears because of silver greatly increase catalytic activity of samples in oxidation of hydrogen, but practically has no influence on activity in CO oxidation. However greater catalytic activity and lesser temperature of conversion maximum were shown on samples with deficiency in A-sublattice. Also increasing the content of silver causes intense decreasing of thermal stability in reduction atmosphere.

Catalytic activity of a series of samples of lanthanum manganite doped by silver was studied in reaction of CO oxidation in air. Catalytic activity in this reaction practically does not depend on the amount of silver. 100% of conversion occurs at temperature of 350°C. This fact is at variance with literature. Authors of that?? Kakoii? article affirms, that samples of compound La₀.₇Ag₀.₃MnO₃ shows 100% of conversion at temperature of 100°C. This
difference may be explained by difference in synthesis method and phase compound of our samples.

Also catalytic activity of our samples was studied in reaction of methane oxidation. Products of methane oxidation on these catalysts are H₂O and CO₂. For silver doped catalyst series, 100% conversion of methane takes place at 400°C and activity of samples weakly increases with increase of silver content. For barium doped series the most active sample is the compound La₀.₈Ba₀.₂MnO₃. 90% of conversion is reached at temperature of 650°C.

In reaction of benzene oxidation we studied catalytic activity of La₀.₉₉Ag₀.₀₀₃MnO₃ sample. Products of reaction with this catalyst are CO₂ and H₂O, so the reaction of deep oxidation took place and this catalyst doesn’t show selectivity.