

the catalytic system is associated with the presence of REE aluminate crystals formed during firing at the interface.^{33,34}

Hydrogenation of o-nitroanisole to o-aminoanisole was studied on 1% palladium catalysts containing holmium and aluminum oxides. The starting nitro compound, o-aminoanisole, are widely used in the aniline paints, chemical-pharmaceutical and food industries. It is known that the o-nitroanisole molecule contains a methoxy group, has a negative induction effect and a positive mesomeric effect. It was found that the rate of hydrogenation of o-nitroanisole on 1% Pd/Ho₂O₃ catalyst exceeds the rate of hydrogenation on 1% Pd/Al₂O₃ by 2.8 times, which shows a greater activity of 1% Pd/Ho₂O₃ catalyst.³⁴

The study of the dependence of the reaction rate of the hydrogenation of nitrobenzene and o-nitroanisole on 1% Pd catalysts containing OREE from the nature of OREE (which is associated with the structure of the electron shell of the elements of the lanthanide series) shows that palladium catalysts OREE, which begin and end the series of lanthanides, have lower activity compared to catalysts containing OREE located in the central part of the lanthanide series (Fig.-3). 1% Pd/Lu₂O₃ and 1% Pd/Pr₂O₃ exhibit low activity in the series of 1% Pd catalysts containing OREE, but their activity is 1.3 times higher than that of the catalyst based on Al₂O₃. So, replacing the usual carrier Al₂O₃ with a rare earth oxide gives an increase in the rate of nitrobenzene hydrogenation from 1.3 (Lu₂O₃) to 4.5 times (Tb₂O₃); in the hydrogenation of o-nitroanisole, from 1.9 (Yb₂O₃) to 3.6 times (Gd₂O₃). In the case of nitrobenzene hydrogenation, the 1% Pd/Tb₂O₃ catalyst has the highest activity and 1% Pd/Gd₂O₃ in the case of o-nitroanisole hydrogenation.

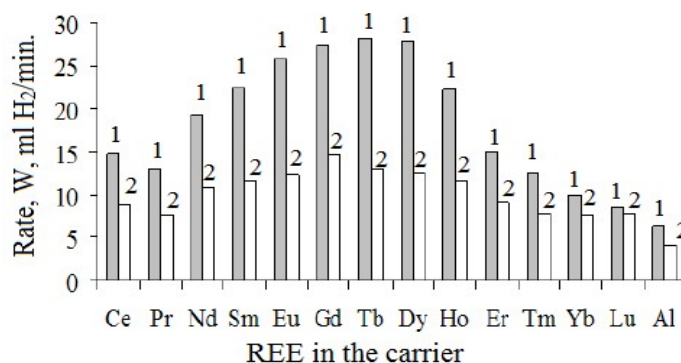


Fig.-3: The Rate of the Hydrogenation Reaction of Nitrobenzene (1) and o-nitroanisole (2) on 1% Pd Catalysts Containing Various Oxides of Rare Earth Elements and Al^{27,31,34}

RESULTS AND DISCUSSION

Palladium Catalysts for Hydrogenation of Nitro Groups in Nitro Compounds with Functional Groups

In literature, the effect of copper on the catalytic properties of a palladium catalyst (5 wt. %) during the hydrogenation of o-, m-, and p-nitrochlorobenzenes has been written in some works.¹⁷ The authors found that the addition of copper to the palladium catalyst decreases the hydrogenating activity of the original catalyst, but when the optimal amount of copper is added to the palladium (<2 at. %) the reaction of chlorine elimination is practically close to zero, while the rate of reduction of the nitro group at pressures of 4.0-10.0 MPa is still at a high level.

Catalysts based on deposited palladium catalysts with copper additives have also shown high selectivity in hydrogenation of nitro groups in nitro compounds with functional groups.³⁵

We have researched supported catalysts based on palladium with different additives (Rh, Ru, Cu, Pt) in the processes of hydrogenation of simple molecules (nitrobenzene, aniline, benzene) and aromatic nitro compounds with one or two nitro groups and different functional groups. For investigation of the high-pressure kinetic installation, the main part of which is or the “duck” made of steel or an improved Vishnevsky autoclave made of titanium has been used. The experiment was carried out according to the method described earlier.^{19,36-38} Liquid phase hydrogenation of aromatic nitro compounds has been studied under the pressure of hydrogen with a variation of temperature, solvents and catalysts composition.