The effect of rare-earth additives (La, Ce, Nd, Gd, Yb, Lu) on Pt/$\gamma$-Al$_2$O$_3$ catalysts was determined for the conversion of n-hexane in the presence of hydrogen, and for the complete oxidation of isobutene. In n-hexane conversion, the rare-earth additives reduce the activity in hydrogenolysis and increase in dehydrocyclization. In complete oxidation, rare-earth additives increase the activity, provided that the catalysts are properly activated.

Rare-earth elements have been known to act as stabilizers of the dispersity of platinum in catalysts and also as promoters in a number of reactions conducted in the presence of hydrogen or oxygen /1–3/.

In the present work, the activity of Pt/Al$_2$O$_3$ catalysts modified by rare-earth additives was determined for n-C$_6$ conversion performed under atmospheric pressure in the presence of hydrogen /4/, and for the complete oxidation of isobutane /5/. Catalysts containing 0.5% Pt deposited on $\gamma$-Al$_2$O$_3$ and catalysts containing the additives: La, Ce, Nd, Gd, Yb and Lu were used. Their characteristics are given in Part I. /6/.
RESULTS AND DISCUSSION

At high temperatures and in the presence of Pt/Al₂O₃ catalysts and hydrogen, hexane undergoes a complex conversion which yields products of cracking, isomerization and dehydrocyclization. The conversion of n-hexane increases with the temperature towards the formation of C₁–C₅ and benzene, whereas the amount of isohexanes in the products of the reaction reaches its maximum between 350 and 400 °C.

Figure 1 illustrates the conversion of n-hexane (α) and also shows the yields of benzene and isohexanes obtained in the presence of Pt/Al₂O₃ catalysts and catalysts modified by rare-earth elements.

The figure shows that rare-earth elements modify the catalytic properties of platinum catalysts in the following way:

- They decrease the complete conversion of n-hexane (α) because of a considerable drop in the activity for hydrogenolysis. The sequence of the effect is: La = Ce = Nd > Lu > Gd > Yb;
- They increase the content of hexane isomers in the reaction products and shift the maximum yield of iso-C₆ towards higher temperatures;
- They increase the benzene content in the reaction products. The sequence is: Ce = Gd > Nd = Yb = Lu > La.

Fig. 1. Effect of rare-earth additives and calcination temperature on n-hexane conversion (The error in the determination of the activity in n-hexane conversion does not exceed 3%).