PYROLYSIS OF PROPANE IN THE PRESENCE OF ETHYLENE

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Pyrolysis of propane in the presence of ethylene and ethylene labeled with $^{14}$C has been studied in the temperature range 773 - 1019 K. The disappearance of the inhibiting effect of ethylene on the thermal decomposition of propane with increasing temperature was observed.

Ethylene is the main product of the thermal decomposition of propane, but its influence on the pyrolysis of propane is not satisfactorily elucidated. It was found that during pyrolysis of propane in the presence of 1% ethylene labeled with $^{14}$C at 803-853 K ethylene is nearly completely converted into ethane. Only very small amounts of radioactivity were found in methane, propane and propylene [1]. Recently, we found that ethylene labeled with $^{14}$C added to propane, at 890 K was mainly converted into ethane, but at 959 K only a very small radioactivity was found in ethane. The radioactivity was found
in methane, ethane, ethylene and propylene, but there was no radioactivity in propane [2]. The observation that ethylene labeled with $^{14}\text{C}$ added to propane is mainly converted into ethane at 790 K was recently confirmed in Ref.[3]. It was also found that ethylene rather strongly inhibits propane pyrolysis at 760-830 K for the molar ratio of ethylene to propane varied from 0.0 to 1.0 [3]. The yields of hydrogen and ethylene decreased and those of ethane and propylene increased in the pyrolysis of propane at 833 K in the presence of 1.6 % and 4.4 % of ethylene [4].

In our previous study it was found that below 900 K, almost all added ethylene is converted into ethane, but above 950 K this process is negligible [2]. So, it seemed to be interesting to investigate the pyrolysis of propane in the presence of ethylene in the extended range of temperature from 773 to 1019 K.

**EXPERIMENTAL**

Pyrolysis of propane in the presence of ethylene was studied in a quartz microreactor by the pulse chromatographic technique [5]. Propane and ethylene (Fluka) were additionally purified by distillation at the temperature of liquid nitrogen. Ethylene labeled with $^{14}\text{C}$ was obtained by the dehydration of ethyl alcohol-$1-^{14}\text{C}$ on $\text{Al}_2\text{O}_3$ at 673 K and then purified chromatographically. The radioactivity was determined by a flow proportional counter [2]. An initial mean pressure of propane (a Gaussian input pulse) determined by the method proposed in [6,7] was equal to 4kP (30 Torr). The molar ratio of ethylene to propane varied in the range of 0-1.0.

**RESULTS AND DISCUSSION**

The initial rates of formation of the major products in the thermal reaction of propane in the temperature range 773-1019 K have been measured in the presence and absence of the added ethylene. In Fig. 1, we have plotted the ratio of the initial reaction rates, measured by hydrogen formation, in