Volume 3, Issue 2, February - 2025 **ISSN (E):** 2938-3811

HISTORY OF THE DEVELOPMENT AND TRANSFORMATION OF METHANE INTO CARBON DIOXIDE

Koybakarob Oybek Ergashovich
Karshi State Technical University

Abstract
The first work on the production of synthesis gas by converting methane to carbon dioxide was published in 1928 [5]. In the 1990s, research on the conversion of carbon dioxide to methane was focused on the production of synthesis gas in various H2/CO ratios for the synthesis of hydrocarbons and petroleum products [18].
The main goal of the research of the NCM was to develop active catalysts that can work for a long time without renewal. In [16, 19], the catalytic activity of some metals (Cu, Fe, Co, Ni, Ru, Ru, Rh, Ir or Pt) was increased by using additives (Al2O3, SiC>2, TiCl, MgO, C, ZnO,SiC,BaO,ZrCl,GeO2 or zeolites) [5]. Precious metal catalysts are more resistant to coke production, but due to their high cost and limited efficiency, they are used for economical purposes.

Introduction
MgO and CaO have been studied because of their high melting points, and their temperature resistance is related to the surface area. In addition, their basicity is believed to reduce coke formation by increasing the activity of CO2, TiO2, and ZrO2. Metal oxides of active metals always serve to increase the activity of strong metals (SMCs).. The CMC is a very important factor in the resistance to coke. The ability of rare earth oxides such as GeO2 and La2O3 to absorb and release oxygen has been studied. Their use as additives increases the activity of the catalyst. The selection of active metals, along with additives for the preparation of catalysts, can also increase the activity of catalysts, since the activity of a catalyst depends on many other factors in addition to its composition, such as preparation methods, heat treatment, activation procedure, composition of active components, addition of active substances, and others. Therefore, some catalytic structures such as Ni/Al2O3 and Ni/MgO have been studied by different research groups and different results and conclusions have been reached.
With the soot gas produced as a result of the catalytic conversion of a gas mixture consisting of methane and carbon dioxide in the gas phase hydrogen mixture opens a wide path to the production of various products in industry.

There are three methods for catalytic conversion of methane into a mixture of hydrogen and carbon monoxide [10; pp. 39-50].

1. **Steam catalytic conversion (steam reforming):**

$CH_4 + H_2O \rightarrow CO + 3H_2$ ΔH= +226 кж/мол

2. Partial oxidation of methane (partial oxidation of methane, oxygen reforming)

$CH_4 + 1/2O_2 \rightarrow CO + 2H_2$ ΔH = -35,6 кж/мол

3. Catalytic conversion of a gas mixture consisting of methane and carbon dioxide into a mixture of carbon monoxide and hydrogen in the gas phase:$CH_4 + CO_2 \rightarrow 2CO + 2H_2$

$\Delta H = +247$ кж/мол.

In industry, almost exclusively steam conversion of methane is used. The reaction is carried out at high temperatures, i.e. at 700-900°C, in the presence of nickel-containing catalysts.

To obtain ammonia from a nitrogen-hydrogen mixture, a mixture of hydrogen and carbon monoxide with a composition of CO + H2 = 1:3 is used.. Recently, it has been proposed to use a 1:1 mixture of hydrogen and carbon monoxide to produce dimethyl ether (1,2). The formal stoichiometry of this reaction corresponds to the following equation.$2CO + 4H_2 \rightarrow CH_3OCH_3 + H_2O$ (5)

However, if we take into account the interaction of H2O and CO (steam catalytic conversion of CO) under these reaction conditions,

$CO + H_2O \leftrightarrow CO_2 + H_2$ $\Delta H = -41$ кж/мол (6)

In practice, to produce dimethyl ether, a mixture of CO:H2 = 1:1 is required:

$3CO + 3H_2 \rightarrow CH_3OCH_3 + CO_2$ (7)

System ($CH_4 + CO_2 = 2CO + 2H_2$) balance

In the catalytic conversion of methane in the gas phase to a mixture of carbon dioxide and hydrogen in the presence of catalysts, equilibrium catalytic conversion of CO + H2 is achieved on nickel and platinum catalysts at 700-800°C.. The main obstacle to the use of nickel catalysts in the catalytic conversion of methane with carbon dioxide in the gas phase in the presence of catalysts is their rapid poisoning by the formation of coke on their surface. There are two ways in which coke is formed in methane decomposition [11;55-72-б].

1. **Separation of methane into elements**

$CH_4 \rightarrow C + 2H_2$; $\Delta H = +74{,}8$ кж/мол (8)

2. Budsar's reaction

$2CO \rightarrow C + CO_2$ $\Delta H = -172$ кж/мол (9)

The first of these is a chemical catalytic reaction, which involves the absorption of heat, and the second is a chemical catalytic reaction, which involves the release of heat. One way to solve the problem is to add or remove heat when obtaining a mixture of hydrogen and carbon dioxide. $CH_4 + CO_2 + H_2$ The generalization of the mixture consists in carrying out reactions (1), (2), (3) and (6) without additional heating, creating a catalytic change in the presence of catalysts. Such a thermoneutral (the necessary heat is obtained by burning part of the raw material in atmospheric oxygen) catalytic change is carried out in the presence of methane $CH_4 + CO_2 + O_2$ can be carried out through the generalization of catalytic changes in the system with the presence of carbon dioxide (3) and oxygen (2) catalysts.

Summary
In the catalytic conversion of methane in the gas phase to a mixture of carbon dioxide and hydrogen in the presence of catalysts, equilibrium catalytic conversion of CO + H2 is achieved on nickel and platinum catalysts at 700-800°C.. The main obstacle to the use of nickel catalysts in the catalytic conversion of methane with carbon dioxide in the gas phase in the presence of catalysts is their rapid poisoning by the formation of coke on their surface

REFERENCES

1. Kuyboqarov O., Anvarova I., Abdullayev B. RESEARCH OF THE CATALYTIC PROPERTIES OF A CATALYST SELECTED FOR THE PRODUCTION OF HIGH-MOLECULAR WEIGHT LIQUID SYNTHETIC HYDROCARBONS FROM SYNTHESIS GAS //Universum: технические науки. – 2023. – №. 10-7 (115). – С. 28-32.
2. Kuyboqarov O., Egamnazarova F., Jumaboyev B. STUDYING THE ACTIVITY OF THE CATALYST DURING THE PRODUCTION PROCESS OF SYNTHETIC LIQUID HYDROCARBONS //Universum: технические науки. – 2023. – №. 11-7 (116). – С. 41-45.
3. Муртазаев Ф.И., Неъматов Х.И., Бойтемиров О.Э., Куйбакаров О.Э., & Каршиев М.Т. (2019). ПОЛУЧЕНИЕ КОМПОЗИЦИЙ НА ОСНОВЕ СЕРЫ И НИЗКОМОЛЕКУЛЯРНОГО ПОЛИЭТИЛЕНА ДЛЯ ДОРОЖНЫХ И СТРОИТЕЛЬНЫХ МАТЕРИАЛОВ. Международный академический вестник, (10), 102-105.
4. Муртазаев Ф.И., Неъматов Х.И., Бойтемиров О.Э., Куйбакаров О.Э., & Каршиев М.Т. (2019). ФИЗИКО-ХИМИЧЕСКИЕ СВОЙСТВА СИНТЕЗИРОВАННЫХ ОЛИГОМЕРОВ ДЛЯ ОБЕССЕРИВАНИЯ ПРИРОДНОГО ГАЗА ОТ СЕРОВОДОРОДА. Международный академический вестник, (10), 105-107.
5. Boytemirov O., Shukurov A., Ne'matov X., & Qo'yboqarov O. (2020). Styrene-based organic substances, chemistry of polymers and their technology. Результаты научных исследований в условиях пандемии (COVID-19), 1(06), 157-160.
6. Куйбокаров О., Бозоров О., Файзуллаев Н., Хайитов Ж., & Худойбердиев И.А. (2022, June). Кобальтовые катализаторы синтеза Фишера-Тропша, нанесенные на Al2O3 различных полиморфных модификаций. In E Conference Zone (pp. 349-351).
7. Куйбокаров О.Э., Бозоров О.Н., Файзуллаев Н.И., & Нуруллаев А.Ф.У. (2022). КАТАЛИТИЧЕСКИЙ СИНТЕЗ ВЫСОКОМОЛЕКУЛЯРНЫХ УГЛЕВОДОРОДОВ ИЗ СИНТЕЗ-ГАЗА В ПОЛИФУНКЦИОНАЛЬНОМ КАТАЛИЗАТОРЕ. Universum: технические науки, (1-2 (94)), 93-103.
8. Куйбокаров О.Э., Бозоров О.Н., Файзуллаев Н.И., & Хайдаров О.У.У. (2021). СИНТЕЗ ВЫСОКОМОЛЕКУЛЯРНЫХ УГЛЕРОДОВ ИЗ СИНТЕТИЧЕСКОГО ГАЗА ПРИ УЧАСТИИ CO-FE-NIZRO2/ВКЦ (ВЕРХНИЙ КРЫМСКИЙ ЦЕОЛИТ). Universum: технические науки, (12-4 (93)), 72-79.
9. Қуйбоқаров О.Э., Шобердиев О.А., Рахматуллаев К.С., & Муродуллаева Ш. (2022). ПОЛИОКСИДНЫЕ КАТАЛИЗАТОРЫ ПЕРЕРАБОТКИ МЕТАНА В СИНТЕЗ ГАЗ. Central Asian Research Journal for Interdisciplinary Studies (CARJIS), 2(5), 679-685.

Web of Scientists and Scholars: Journal of Multidisciplinary Research

10. Rustamovich O.N., Ergashovich K.O., Khujanazarovna K.Y., Ruzimurodovich K.D., & Ibodullaevich F.N. (2021). Physıcal-Chemıcal and Texture Characterıstıcs of Coate-Fe-Ni-ZrO2/YuKS+ Fe3O4+ d-FeOON. Turkish Online Journal of Qualitative Inquiry, 12(3).
11. О.Э.Куйбокаров.,Т.Х.Сайфуллаев Конверсия метана в карбонат на молибденовых и циркониййных катализаторах Universum: технические науки. Выпуск: 12(117) Декабрь 2023 год.
12. О.Э.Куйбокаров. Контроль качества препарата самарий153sm-оксобифор Universum: технические науки. Выпуск: 3 (120) март 2024 год.
13. Qo‘yboqarov O.E. Metanni karbonatli konversiyalanishi Sanoatda raqamli texnologiyalar 2(1). (2024).
14. Oybek Kuybokarov, Muradulla Karshiyev, Ganisher Rakhimov, Research of the catalytic properties of a catalyst selected for the production of high-molecular weight liquid synthetic hydrocarbons from synthesis gas E3S Web Conf. III International Conference on Actual Problems of the Energy Complex: Mining, Production, Transmission, Processing and Environmental Protection (ICAPE2024) Volume 498, 2024.