ENCLOSURE (B) 10

SYNTHESIS OF ISOBUTANOL FROM WATER GAS

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LIST OF TABLES AND ILLUSTRATIONS

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SUMMARY

Some experiments were made to study the synthesis of i-butanol from water gas with Zn-Cr-alkali catalysts. The composition of the best catalyst was Zn : Cr = 7 : 3 (atomic ratio).

I. INTRODUCTION

A. History of Project

In Japan, commercial isooctane was prepared from n-butanol, but its octane number was comparatively low. To increase the octane value, a purer isooctane was required and, in this connection, the present study was undertaken to find a good catalyst for synthesis of i-butanol from water gas. The results of these experiments are incomplete because the project was discontinued.

B. Key Research Personnel Working on Project

Chem. Eng. Lt. Comdr.	A. YAMAOKA
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II. DETAILED DESCRIPTION

A. Apparatus and Test Procedure

The apparatus and operating procedure used in this study were the same as described in a previous report on the methanol synthesis. Zn-chromite catalysts were used which were prepared in the same manner as those described in the methanol synthesis, except for the fact that no copper was included.

The powder catalysts were each mixed with 30% by weight of K_2CO_3 and air dried. The feed gas consisted of a mixture of one volume of CO and two volumes of H_2.

The liquid reaction product contained i-butanol, methanol, other alcohols, and water. Determination of the content of i-butanol and methanol was made by the distillation of the product.

B. Experimental Results

1. The relation between the composition of the catalyst and the yield of i-butanol is shown in Table I(B)10.

2. Results of an activity life test of the catalyst (Zn : Cr = 7 : 3), using a gas of CO : H_2 = 1 : 1, are shown in Table II(B)10.

III. CONCLUSIONS

A. When water gas of the composition CO : H_2 = 1 : 1 was passed over Zn-chromite catalyst heated to 450-475°C, under 250kg/cm^2 pressure, and space velocity 5000, the space time yield of liquid product was 0.25~0.35. The contents of i-butanol and methanol were each about 25%.

B. The most effective catalyst studied had an atomic ratio Zn : Cr of 7 : 3. This catalyst maintained its activity for 200 hours.

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Table I(B)10

SYNTHESIS OF ISO-BUTANOL FROM WATER GAS

Catalyst (Zn:Cr)	S.T.Y. of Liquid Product (gm/cc/hr)	Content of i-Butanol (wt%)
10:0	0.10	10
7:3	0.20	15
5:5	0.14	12
3:7	0.10	8
0:10	0.09	7

Reaction pressure.....200kg/cm^2
Reaction temperature.....450-475°C
S.V. 5000

Table II(B)10

LIFE OF CATALYST IN SYNTHESIS OF I-BUTANOL FROM WATER GAS

Duration (hr)	S.T.Y. of Liquid Product (gm/cc/hr)	Content of i-Butanol (wt%)	Content of CH_3OH (wt%)
20	0.25	27	30
80	0.25	23	35
120	0.30	22	30
160	0.35	25	25
200	0.25	25	25

Reaction pressure.....250kg/cm^2
Reaction temperature.....450-475°C
S.V. 5000