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APPENDIX A

SAMPLE CALCULATION OF CATALYST PREPARATION

The sample calculation shown below is for 0.3 wt.% Pt- 0.3 wt.% Sn- 0.6 wt.% K/γ-Al_2O_3 catalyst. The hydrochloric acid is also added to the impregnating solution by 5 wt % of the alumina support. The alumina support weight used for all preparation is 2 grams.

If X grams of alumina support is used, so each 100 grams of the catalyst is composed of

	Platinum	0.3	g.
	Tin	0.3	g.
	Potassium	0.6	g.
	Hydrochloric acid	0.05 x X	g.
	Alumina support	X	g.
then	0.3 + 0.3 + 0.6 + (0.05xX) + X	= 100	g.
	X	= 94.0952	g.

The platinum compound used is chloroplatinic acid ($H_2PtCl_6.6H_2O$), its molecular weight is 517.92, and the platinum content in the compound is 37.67 wt %. The stock solution of chloroplatinic acid has the concentration of 1 g in 25 ml. of water.

The tin compound used is stannous chloride dihydrate ($SnCl_2.2H_2O$), its molecular weight is 118.69, and the tin content in the compound is 51.02 wt.%.

The potassium compound used is potassium nitrate (KNO_3), its molecular weight is 101, and potassium content is 38.61 wt.%. The stock solution of potassium nitrate has the concentration 3 g in 25 ml. of water.

Concentration of hydrochloric acid solution is 37 % volume by volume, its density is 1.19 kilogram per liter.

The calculation procedure of the amount of each ingredients for the required composition of the 0.3 wt.% Pt- 0.3 wt.% Sn- 0.6 wt.% K catalyst shows below.

For two grams of alumina support used :

1) Platinum required	= (0.3x2)/94.10	g.
	= 6.37×10^{-3}	g.
Chloroplatinic acid required	= $6.37 \times 10^{-3} \times 100 \times 25/37.67$	ml.
	= 0.4232	ml.
2) Tin required	= 2x0.3/94.0952	g.
	= 6.376×10^{-3}	g.
Stannous chloride dihydrate required		
	= $6.376 \times 10^{-3} \times 100/51.02$	g.
	= 0.0125	g.
3) Potassium required	= 2x0.6/94.0952	g.
	= 0.0128	g.
Potassium nitrate required	= 0.0128x100x25/(38.61x3)	ml.
	= 0.2763	ml.
4) Hydrochloric and solution required		
	= 2x0.05	g.
	= 0.1	g.
The amount of hydrochloric and by volume		

= 0.1/(1.190x0.37) ml.

= 0.2271 ml.

As the pore volume of the alumina support is 1 ml./g., the total volume of impregnating solution that must be used is 2 ml. by the requirement of dry impregnation method, the de-ionized water is added until the volume of impregnating solution is 2 ml. as equal to the volume of the alumina pore volume.

APPENDIX B

CALCULATION OF METAL ACTIVE SITES

To calculation metal active sites of the catalyst by purity CO adsorption at room temperature have the procedure as follow :

Let the weight of catalyst used	= w	g.
Height of CO peak after adsorption	= A	unit.
Height of 40 µl. standard CO peak	= B	unit.
Amounts of CO adsorbed on catalyst	= B-A	unit.
Volume of CO adsorbed on catalyst	= [(B-A)/B](40)	µl.
Volume of gas 1 mole at 30 °C	= 24.86×10^{6}	µl.
Mole of CO adsorbed on catalyst	= $[(B-A)/B]\{40/24.86 \times 10^{6}]$	mole.
Molecule of CO adsorbed on catalyst	= $1.61 \times 10^{-6}[\{B-A)/B](6.02 \times 10^{23})$	molecules
Metal active sites	= $9.68 \times 10^{17}[(B-A)/B]$	molecules of CO/g.catal.

APPENDIX C

THE AMOUNTS OF COVERED METAL ACTIVE SITES BY COKE DEPOSITION

C.1 Calculation of amount of metal active sites covered by coke deposition

A = Metal active sites of fresh catalyst.

B = Metal active sites of spent catalyst.

C = Metal active sites of regenerated catalyst at 200 °C.

$$\% \text{ Total coke covered on metal active sites (\%TC)} = \frac{A-B}{A} \times 100$$

$$\% \text{ High temperature coke covered on metal active sites (\%HC)} = \frac{A-C}{A} \times 100$$

$$\% \text{ Low temperature coke covered on metal active sites (\%LC)} = \frac{C-B}{A} \times 100$$

APPENDIX D

SPECIFICATION OF ALUMINA SUPPORT (Al_2O_3) TYPE KNH-3 FROM SUMITONO ALUMINIUM SMELTING CO.,LTD.

Chemical Composition (weight percent)	
Al_2O_3	60-70 %
SiO_2	30-35 %
Fe_2O_3	0.3-0.5 %
TiO_2	0.5-0.7 %
CaO	0.1-0.2 %
MgO	0.2-0.4 %
Na_2O	0.3-0.4 %
K_2O	0.2-0.3 %
$ZrO_2 + HfO_2$	0.03-0.04 %

Physical Properties	
Bulk Density (g/cc)	1.3-1.5
Apparent Specific Gravity	3.1-3.3
Packing Density (lb/ft^3)	20-25
Por Volume (cc/g)	1.0-1.3
Surface Area (m^2/g)	340-350

VITA

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