

as seen from FIG. 1, in case wherein a relatively large proportion of gamma-alumina is used in activated alumina (before coated), a large amount of the fine pores seems to be exist in the coating layer before being subjected to an excessively high temperature. However, gamma-alumina is an activated alumina which is heat-treated at a temperature lower than that for delta-alumina, and therefore gamma-alumina is inferior in thermal durability as compared with delta-alumina. As a result, when the final catalyst prepared by using activated alumina (before coated) containing a relatively large proportion of gamma-alumina is used for purification of high temperature exhaust gases, a considerable collapse of the fine pores in the coating layer takes place so that the effectiveness of catalytic metals carried in the fine pores is lost to a great extent as compared with the final catalyst which is prepared by using activated alumina containing not less than 60 Wt% of delta-alumina. The above-discussed fact will be proven in item (2) described hereinafter.

While an activated alumina which is prepared by heating at a high temperature has been described to be excellent from a point of view of catalytic activity, theta-alumina which is prepared by being heat-treated at a generally higher temperature than for delta-alumina is not suitable for the purpose of obtaining high performance catalyst, because the specific surface area of a coating layer formed on the carrier is too low to carry a sufficient amount of catalytic metals. This may result in remarkable lowering in the conversion efficiency particularly of hydrocarbons in exhaust gases.

#### (2) Determination of Conversion Efficiency of final catalyst after thermal durability test

The conversion efficiencies of the final catalysts (60 ml: 36 mm diameter  $\times$  60 mm length) prepared using Samples shown in Table 1 were determined on a bench apparatus at 27,500 gas hourly space velocity (GHSV) by using a synthetic exhaust gas mixture consisting of 1 volume percent CO, 2 volume percent O<sub>2</sub>, 1500 ppm C<sub>2</sub>H<sub>4</sub>, 500 ppm NO, 12 volume percent CO<sub>2</sub>, 10 volume percent H<sub>2</sub>O and N<sub>2</sub> balance. This determination of the conversion efficiency was carried out after the thermal durability test which was taken place under the same condition as that in the above-mentioned item (1). The conversion efficiency of C<sub>2</sub>H<sub>4</sub> at 300° C. was determined and plotted in FIG. 3 which demonstrates that the conversion efficiencies of the final catalysts prepared using Samples (a), (b), (c), (h) and (i) were maintained considerably high even after the thermal durability test, as compared with the final catalysts prepared using Samples (d), (e), (f), (j), (k) and (l). Therefore, it will be understood also from FIG. 3, that the final catalysts prepared using activated alumina (before being coated) containing not less than 60 Wt% of delta-alumina are excellent in thermal durability, as compared with the final catalysts prepared using activated alumina (before being coated) containing less than 60 Wt% of the same. In this connection, the conversion efficiency with regard to a particular gas component is represented as the percentage of the amount of the particular gas component converted by the final catalyst, with respect to the amount of the particular gas component in the synthetic exhaust gas mixture before contacting the catalyst.

It seems from FIG. 3, that, in case of the final catalyst prepared by using activated alumina (before being coated) containing less than 60 Wt% of delta-alumina, a

considerably large amount of the fine pores in the coating layer is collapsed to show considerable lowering in activity of catalytic metals carried in the fine pores formed at the coating layer on the carrier. On the contrary, if the final catalyst prepared by using activated alumina (before being coated) containing not less than 60 Wt% of delta-alumina, the conversion efficiency or activity of the catalyst is still considerably high even after the thermal durability test, which shows that collapse of a large amount of the fine pores does not occur when subjected to an excessively high temperature.

#### (3) X-ray Diffraction Analysis of Coating Layer

Table 2 shows the result of X-ray diffraction analysis of the coating layers prepared by using Samples shown in Table 1 as an activated alumina with respect to before and after the above-mentioned thermal durability test. This result demonstrates that a considerably large amount of delta-alumina was found to exist in the coating layers prepared by using activated alumina (before being coated) containing not less than 60 Wt% of delta-alumina, throughout before and after the thermal durability test. This supports the fact that particularly high thermal durability is exhibited in final catalysts having the carrier coated with the coating layer prepared by using activated alumina (before being coated) containing not less than 60 Wt% of delta alumina.

TABLE 2

Samples	Before T. D. Test aluminas			After T. D. Test aluminas			
	$\delta$	$\gamma$	$\chi$	$\delta$	$\kappa$	$\theta$	$\alpha$
(a)	A	None	None	A	None	A	D
(b)	A	C	D	A	None	A	D
(c)	A	B	C	A	D	B	C
(d)	B	A	B	C	B	B	C
(e)	C	A	B	D	B	B	B
(f)	None	A	A	None	D	C	B
(h)	A	C	None	A	None	A	D
(i)	A	B	None	A	None	A	D
(j)	B	A	None	A	None	A	C
(k)	C	A	None	A	None	A	C
(l)	None	A	None	B	None	B	A

Note:

The amount of alumina is A > B > C > D.

#### (4) Measurement of Peeled Alumina Amount from the Coating Layer

Each coated carrier (before immersion in the solution containing the catalytic metals) prepared by EXAMPLE 8 was dipped in one liter of water contained in a vessel having a volume of 12 liters, which vessel forms part of a device solid under the trade name of "Ultrasonic Tank" by Kaijo Denki Co., Ltd. (in Japan). The coated carrier is of a cylindrical shape having a diameter of 50 mm and a length of 60 mm. Thereafter, ultrasonic vibration (29 KHz, 150 W) was applied to the coated carrier through water for about 20 minutes. The amount of alumina which was peeled off from the carrier was then measured to calculate the peeled alumina amount (Wt%) of the coating layer, based on the weight of the coating layer.

The peeled alumina amounts from the coating layers in various cases are shown in FIG. 4 which demonstrates that the peeled alumina amount of the final catalysts prepared using Samples (d), (e) and (f) are considerably great. Hence, if the activated alumina to be coated does not contain not less than 60 Wt% of delta-alumina, the coating layer formed on the carrier is ex-