Supplementary Information

Sulphation and ammonia regeneration of Pt/MnO_x-CeO_2/Al_2O_3 catalyst for NO_x-assisted soot oxidation

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(1) Calculation process of the sulphate amounts on the sulphated and regenerated samples.

The difference of mass loss between the sulphated/regenerated sample and the fresh one within the temperature range at 400 - 1100 °C in the TGA analyses in Fig. 7 was attributed mainly to the decomposition of sulphates. The decomposition followed the reaction of:

$$2SO_4^{2-} \rightarrow 2SO_3 + 2O^{2-}$$
$$\text{or } 2SO_4^{2-} \rightarrow 2SO_2 + O_2 + 2O^{2-}$$

Hence, the amount of sulphates deposited on the samples was estimated roughly by the following equation.

$$m\left(SO^{2-}_4\right) = \frac{M\left(SO^{2-}_4\right)}{M\left(SO_3\right)} \times m(SO_3)$$

where $m(SO_3)$: mass loss difference between the sulphated/regenerated sample and the fresh one at 400 – 1100 °C by the TG data in Table 3, $M(SO_4^{2-})$: relative mass of SO_4^{2-} = 96.06, and $M(SO_3)$: relative mass of SO_3 = 80.06.

(2) Calculation process of the overall Pt surface area per gram sample.

With the assumption that Pt particles were hemisphere shape on the support, the number of platinum particles on 1 g samples was calculated as:

$$n(Pt) = \frac{m(Pt)}{\rho(Pt)} / (\frac{2}{3}\pi R^3)$$

where m(Pt): mass of platinum in 1 g sample = 0.01 g, ρ(Pt): density of platinum = 21.45 g·cm^{-3}, R: average radius of platinum particles estimated from the TEM images.

The average surface area of each particles followed the equation of:

$$S_0 = 2\pi R^2$$

Hence, the overall Pt surface area per gram sample was:

$$S = S_0 \times n(Pt)$$

$$= \frac{3m}{\rho R}$$

$$= \frac{1.4 \times 10^3\ m^3 \cdot g^{-1}}{R}$$