Supplementary Material (ESI) for Chemical Communications

Strong support-effect on catalytic activity of gold nanoparticles for hydrogen peroxide decomposition

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Experimental details

Catalyst preparation and characterization

Bismuth vanadate ($BiVO_4$) was prepared by the reported procedure and other metal oxides (MO) were purchased from Aldrich. Au particles were loaded on MO particles by the deposition-precipitation (DP) method using $HAuCl_4$ and NaOH as a starting material and a neutralizer, respectively. All the MO particles were heated at 923 K for 4 h prior to the use for the preparation of Au/MO, which enables to neglect the changes of MO with different T_c. All the Au/MOs are stored in the dark. The mean diameters of the Au NPs were determined by transmission electron microscopy at an applied voltage of

300 kV (JEM-3010, JEOL). The loading amount of Au was quantified by inductively coupled plasma spectroscopy (ICPS-7500, Shimadzu).

H_2O_2 decomposition

Au/MO (200 mg) or MO (200 mg) was added to a 4.5×10^{-3} mol dm^{-3} H_2O_2 aqueous solution (200 mL), and stirred at 298 K in the dark. The H_2O_2 concentration of the filtrate at each reaction time was determined by the reduction-oxidation titration by $KMnO_4$.

H_2O_2 decomposition in various pH

By using 1 mol dm^{-3} NaOH and 1 mol dm^{-3} H_2SO_4 aqueous solutions, pH of a 4.5×10^{-3} mol dm^{-3} H_2O_2 aqueous solution was adjucted to the selected value. $Au/SrTiO_3$ and Au/TiO_2 (10 mg) was added to the H_2O_2 aqueous solution (100 mL), and stirred at 298 K in the dark. The H_2O_2 concentration of the filtrate at each reaction time was determined by the reduction-oxidation titration by $KMnO_4$.

By using H_2O_2, Au/MOs-catalyzed oxidation of cinnamyl alcohol

Au/MOs (25 mg) or MO (25 mg) added to a cinnamyl alcohol (4.0×10^{-3} mol dm^{-3}) solution (H_2O : acetonitrile = 9 : 1 v/v) (25 mL) with H_2O_2 (4.8×10^{-3} mol dm^{-3}), and the suspension was stirred at 298 K or 328 K in the dark for 1 h or 3 h. The yield was determined by UV/Vis spectroscopy (UV-1800, Shimadzu). No generation of cinnamaldehyde was observed for all the MOs without Au NP loading.

Table S1. Isoelectric point of MO-support (IEP), Au loading amount, Au particle size *d*, standard deviation σ, number of count and heating temperature T_c and time t_c.

catalyst	IEP	Au mass%	d / nm	σ / nm	count	T_c / K	t_c / h
$Au/SrTiO_3$	2.4	0.63	8.4	1.9	133	873	24
Au/ZnO	9.8	0.73	17.3	4.9	135	873	4
Au/TO_2	6.0	0.25	7.7	1.1	105	873	4
$Au/BiVO_4$	2.3	0.30	16.1	3.9	106	873	4
Au/WO_3	1.5	0.07	11.1	2.1	88	873	4
Au/In_2O_3	2.5	0.78	11.0	1.8	92	873	4
$Au/SrTiO_3$	2.4	0.61	3.9	1.2	111	773	4
$Au/SrTiO_3$	2.4	0.62	2.7	0.6	128	673	4

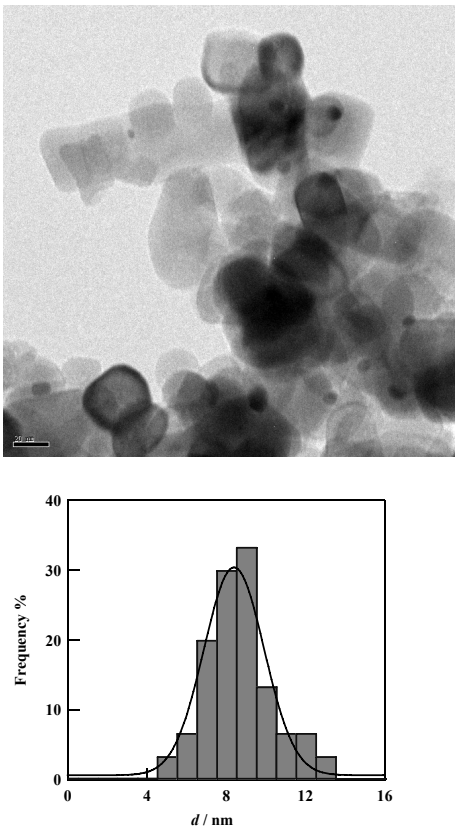

Fig. S1 TEM image and size distribution of Au/$SrTiO_3$ (d = 8.4 nm).

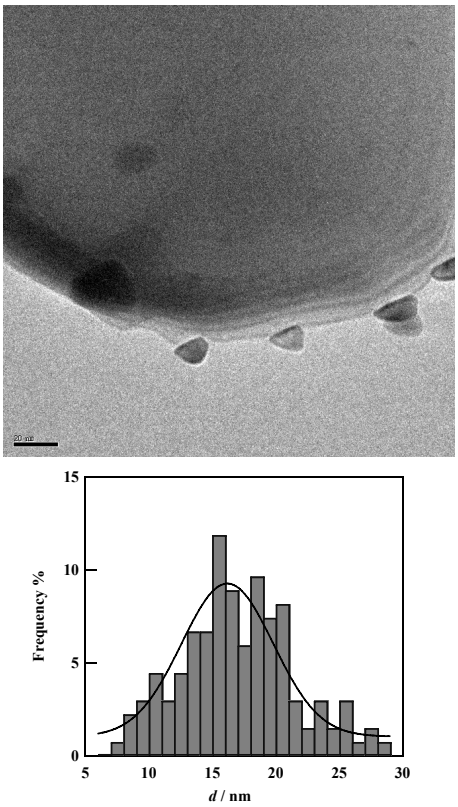

Fig. S2 TEM image and size distribution of Au/ZnO.

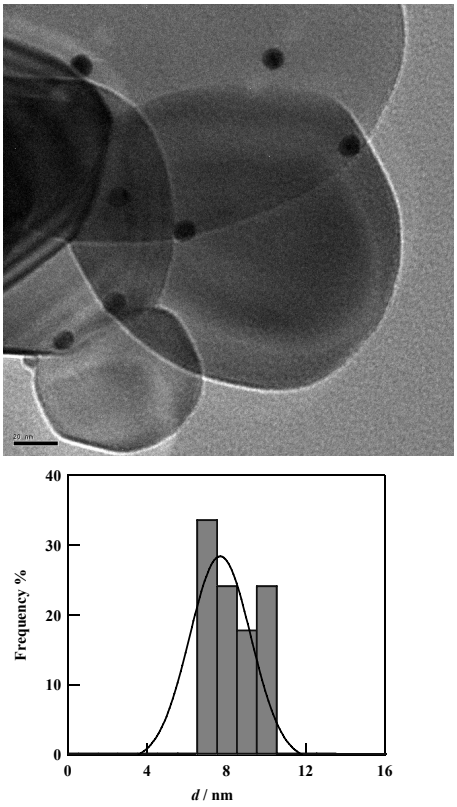

Fig. S3 TEM image and size distribution of Au/TiO_2 (d = 7.7 nm).

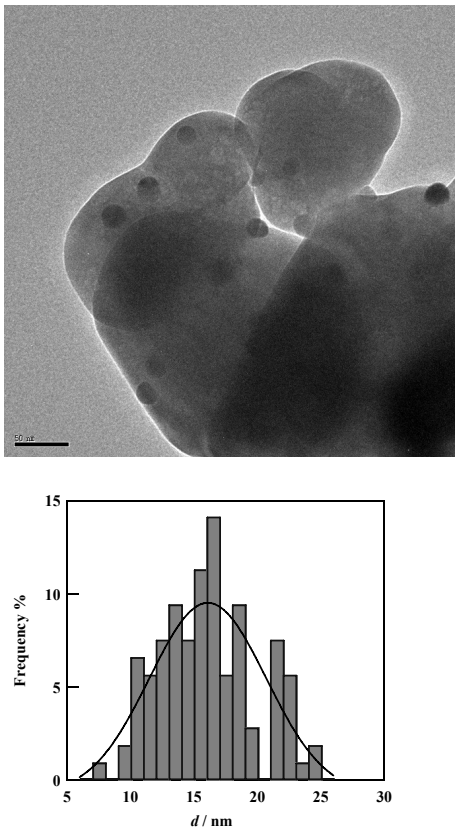

Fig. S4 TEM image and size distribution of Au/$BiVO_4$.

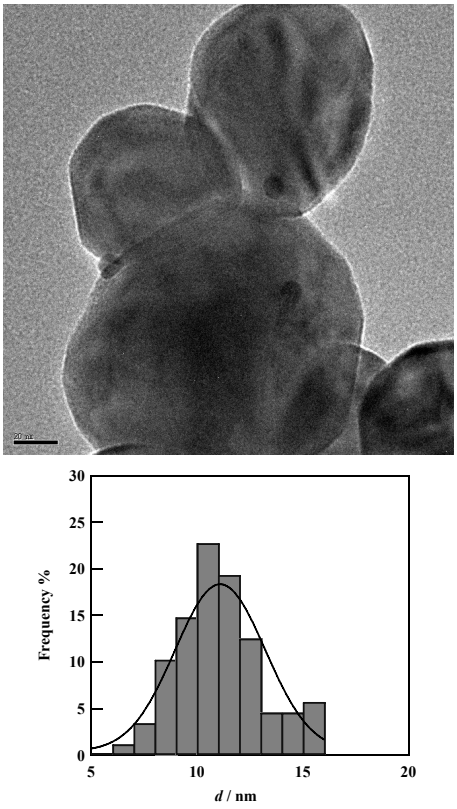

Fig. S5 TEM image and size distribution of Au/WO_3.

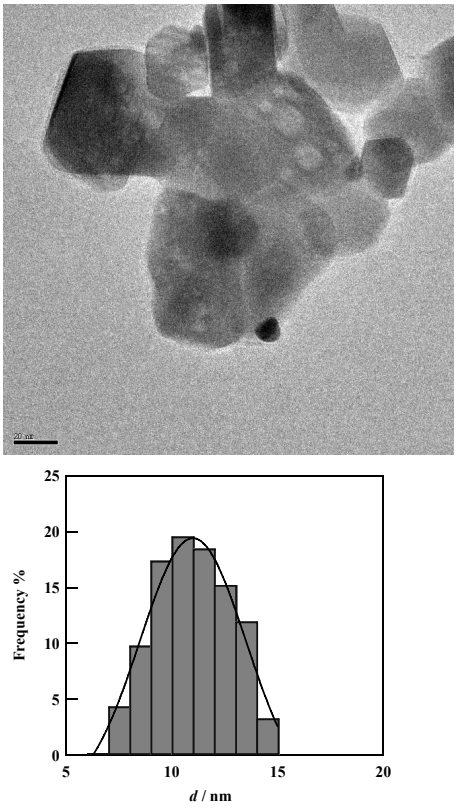

Fig. S6 TEM image and size distribution of Au/In_2O_3.

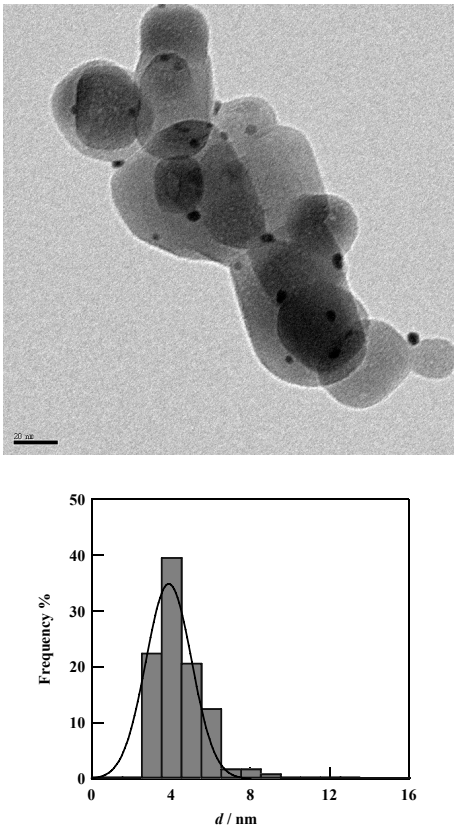

Fig. S7 TEM image and size distribution of $Au/SrTiO_3$ (d = 3.9 nm).

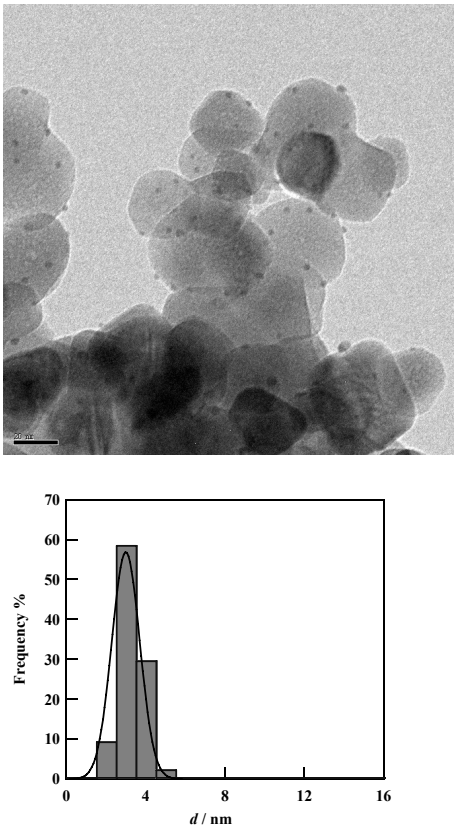

Fig. S8 TEM image and size distribution of $Au/SrTiO_3$ (d = 2.7 nm).

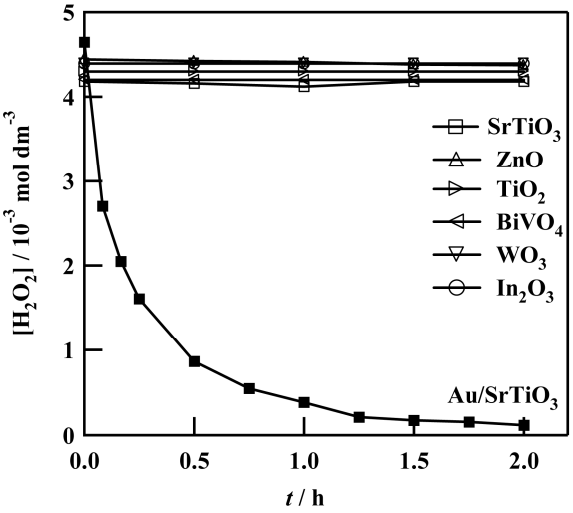

Fig. S9 Plots of $[H_2O_2]$ in the presence of MOs without Au NP loading and $Au/SrTiO_3$ (d = 8.4 nm) at pH 6 *vs.* t.

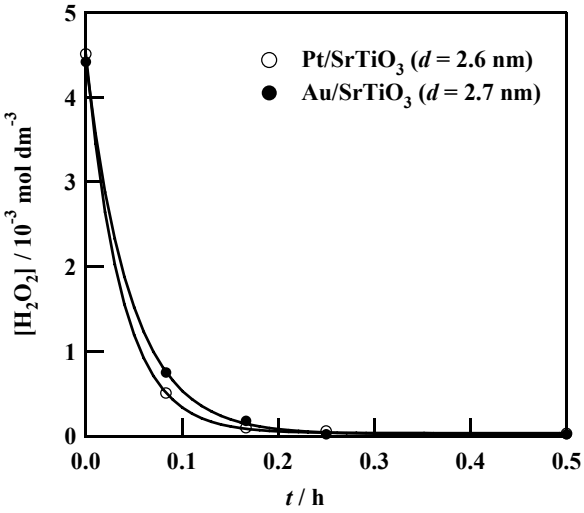

Fig. S10 Plots of $[H_2O_2]$ in the presence of $Pt/SrTiO_3$ (d = 2.6 nm) and $Au/SrTiO_3$ (d = 2.7 nm) at pH 6 *vs.* t.