Supplementary Information

Ordered Intermetallic Pt-Cu Nanoparticles for Catalytic CO Oxidation Reaction

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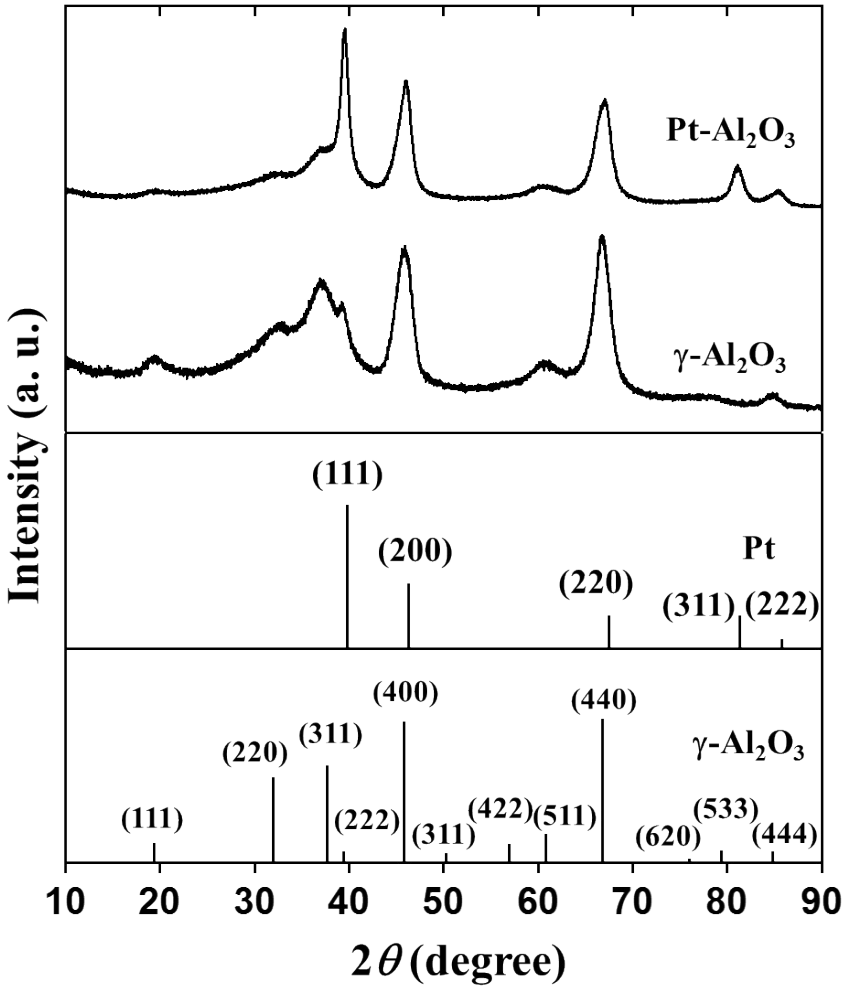

Figure S1. X-ray diffraction profiles of γ-Al_2O_3 and Pt/γ-Al_2O_3. The simulated solid lines are shown at the bottom for reference purpose.

Figure S1 shows the pXRD profiles of γ-Al_2O_3 and Pt/γ-Al_2O_3. The characteristic diffraction peaks were obtained for both γ-Al_2O_3 (*Fd***Error!***m*, *a* = 0.79) and Pt/γ-Al_2O_3 (*Fm***Error!***m, a* = 0.3924 nm), consistent with the simulated lines as also shown in Figure S1.

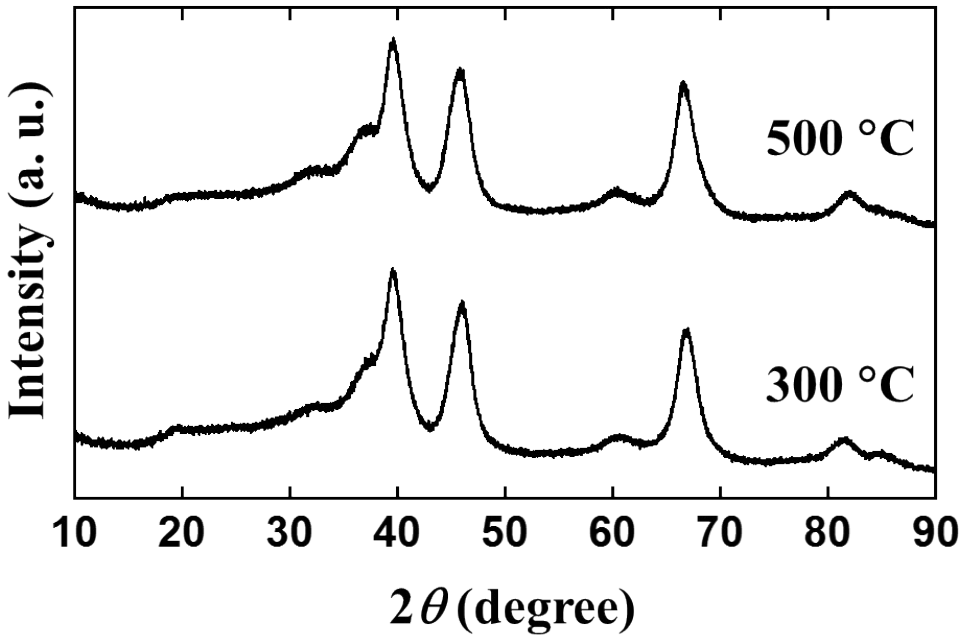

Figure S2. X-ray diffraction profiles of Pt- and Cu- precursors coated γ-Al_2O_3 calcined at 300 and 500 °C for the preparation of intermetallic Pt_3Cu/γ-Al_2O_3.

Figure S2 shows the pXRD profiles of Pt- and Cu- precursors coated γ-Al_2O_3 calcined at 300 and 500 °C. The characteristic diffraction peaks of intermetallic Pt_3Cu (*Pm***Error!***m*; *a* = 0.3852 nm) were not obtained when the precursors calcined at 300 and 500 °C. The intermetallic Pt_3Cu phase was obtained solely when the precursors calcined at 800 °C (Figure 2 and corresponding discussion in the main text). The resultant products were identified after calcination of the precursors at 300 and 500 °C as γ-Al_2O_3 and Pt. Cu-moieties (metallic Cu or Cu-oxides) were not obtained in both pXRD profiles due to either lower amounts of Cu (0.54 wt.%) or merging of their characteristic diffraction peaks with γ-Al_2O_3. These results infer that the intermetallic Pt_3Cu phase can be achieved only at 800 °C but not at 300 and 500 °C under H_2.

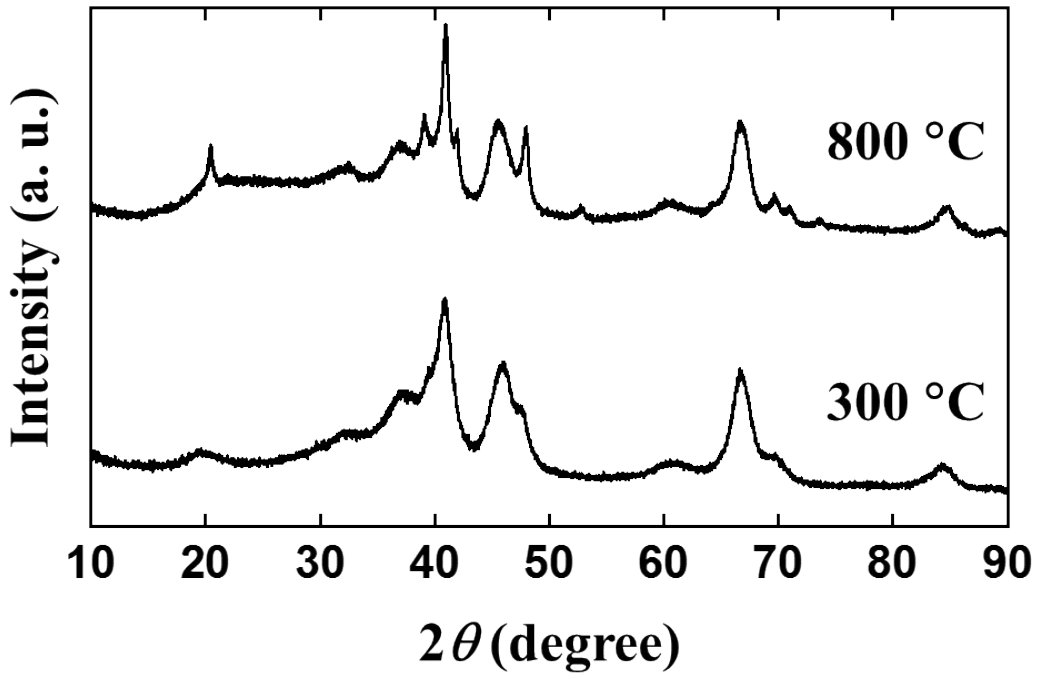

Figure S3. X-ray diffraction profiles of Pt- and Cu- precursors coated γ-Al_2O_3 calcined at 300 and 800 °C for the preparation of intermetallic PtCu/γ-Al_2O_3.

Figure S3 shows the pXRD profiles of Pt- and Cu-precursors coated γ-Al_2O_3 calcined at 300 and 800 °C. The characteristic diffraction peaks of intermetallic PtCu (*Rm; a* = *b* = 0.270 nm; *c* = 1.2918 nm) were not obtained when the precursors calcined at 300 and 800 °C. The intermetallic PtCu phase was obtained solely when the precursors calcined at 500 °C (Figure 2 and corresponding discussion in the main text). The resultant products after calcination of the precursors at 300 °C were identified as γ-Al_2O_3 and Pt. Cu-moieties (metallic Cu or Cu-oxides) were not obtained in both XRD profiles due to likely merging of their characteristic diffraction peaks with Al_2O_3. The resultant products after calcination of the precursors at 800 °C were identified as the mixture of PtCu and $PtCu_3$. These results infer that the intermetallic PtCu phase can be achieved by the calcination of the precursors only at 500 °C but not at 300 and 800 °C under H_2.

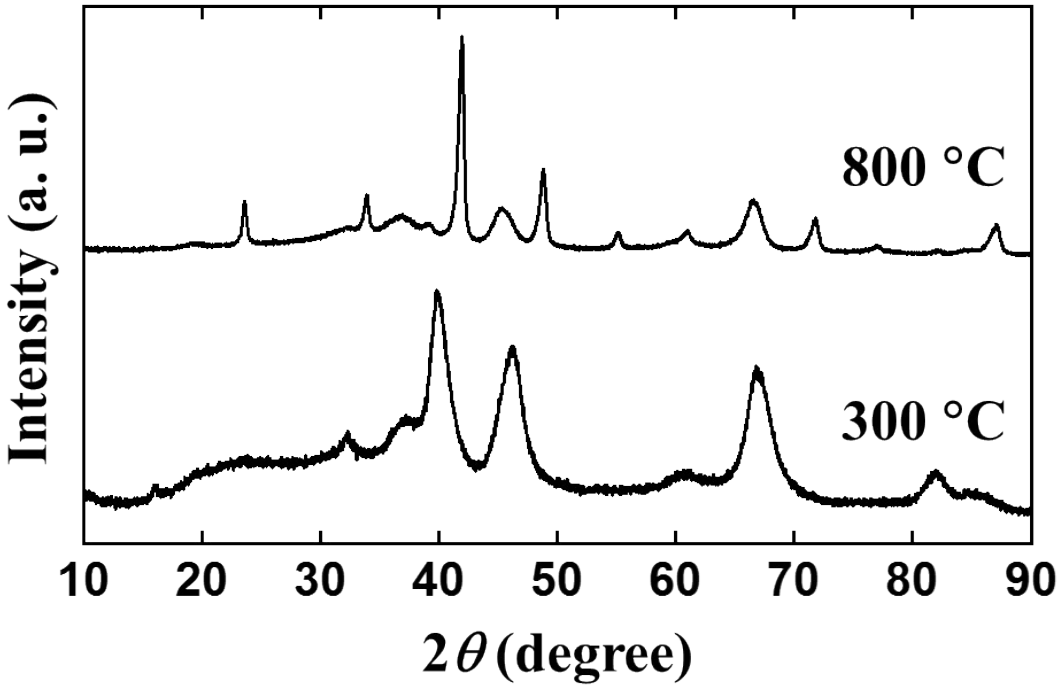

Figure S4. X-ray diffraction profiles of Pt- and Cu- precursors coated γ-Al_2O_3 calcined at 300 and 800 °C for the preparation of intermetallic $PtCu_3$/γ-Al_2O_3.

Figure S4 shows the pXRD profiles of Pt- and Cu-precursors coated γ-Al_2O_3 calcined at 300 and 800 °C. The characteristic diffraction peaks of intermetallic $PtCu_3$ (*Pm***Error!***m; a* = 0.3692 nm) were not obtained when the precursors calcined at 300 and 800 °C. The intermetallic PtCu phase was obtained solely when the precursors calcined at 500 °C (Figure 2 and corresponding discussion in the main text). The resultant products after calcination of the precursors at 300 °C were identified as γ-Al_2O_3 and Pt. Cu-moieties (metallic Cu or Cu-oxides) were not obtained in both XRD profiles due to likely merging of their characteristic peaks with γ-Al_2O_3. The resultant products after calcination of the precursors at 800 °C were identified as the mixture of PtCu and $PtCu_3$. These results infer that the intermetallic $PtCu_3$ phase can be achieved by the calcination of the precursors only at 500 °C but not at 300 and 800 °C under H_2.

ICP-MS results

Table 1. Calculated and estimated amounts of Pt and Cu in intermetallic Pt-Cu catalysts

Sample	Calculated, Pt		Estimated, Pt		Calculated, Cu		Estimated, Cu	
	Weight (mg)	Weight %	Weigh t (mg)	Weight %	Weight (mg)	Weight %	Weigh t (mg)	Weight %
Pt/Al_2O_3	0.5	5	0.492	4.92	-	-	-	-
Pt_3Cu/Al_2O_3	0.5	5	0.513	5.13	0.054	0.54	0.062	0.62
$PtCu/Al_2O_3$	0.5	5	0.482	4.82	0.163	1.63	0.156	1.56
$PtCu_3/Al_2O_3$	0.5	5	0.522	5.22	0.5	5	0.530	5.30