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Supplementary Information

Bimetallic (Au–Cu core)@(Ceria shell) nanotube for Photocatalytic Oxidation of Benzyl Alcohol: Improved Reactivity by Cu

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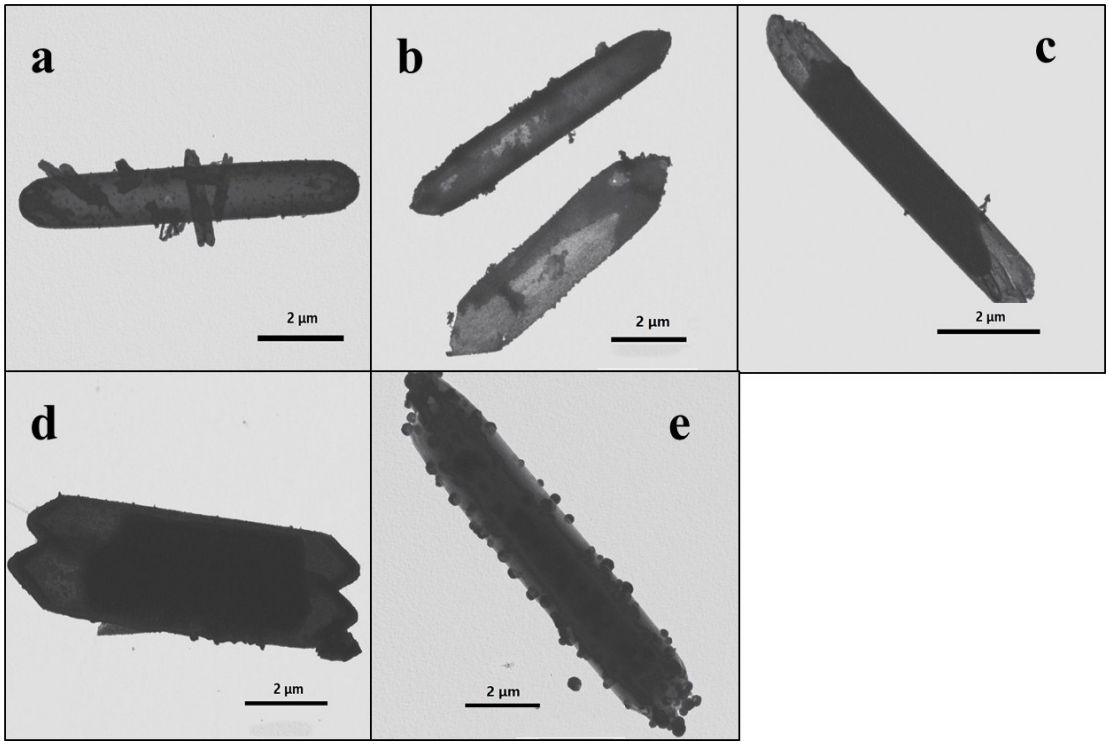

Fig. S1. TEM of samples before calcined with different Au-Cu deposition. (a) Au, (b) Au8Cu2, (c) Au5Cu5, (d) Au1Cu9, and (d) Cu.

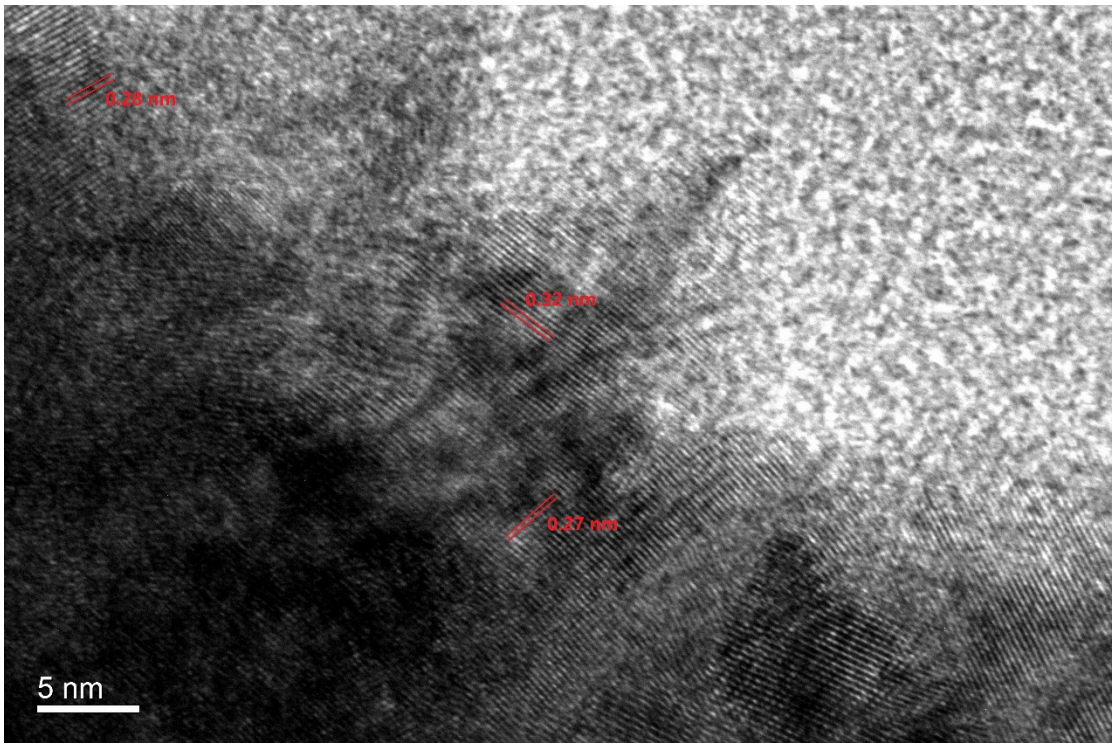

Fig. S2. HRTEM of $Au_5Cu_5@CeO_2$.

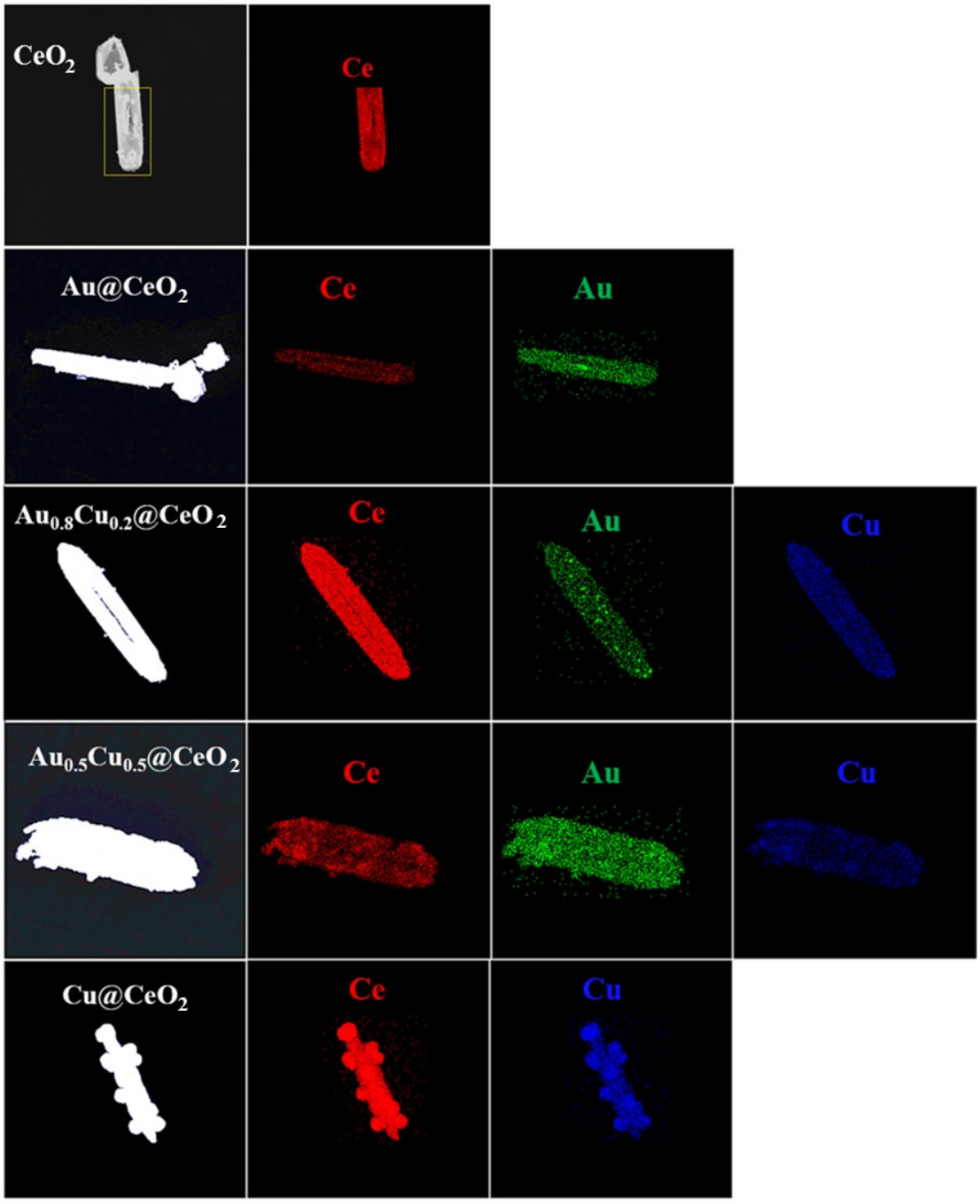

Fig. S3. STEM-EDX mapping of CeO_2 nanorods, $Au@CeO_2$, $Au_8Cu_2@CeO_2$, $Au_5Cu_5@CeO_2$, $Au_1Cu_9@CeO_2$ and $Cu@CeO_2$.

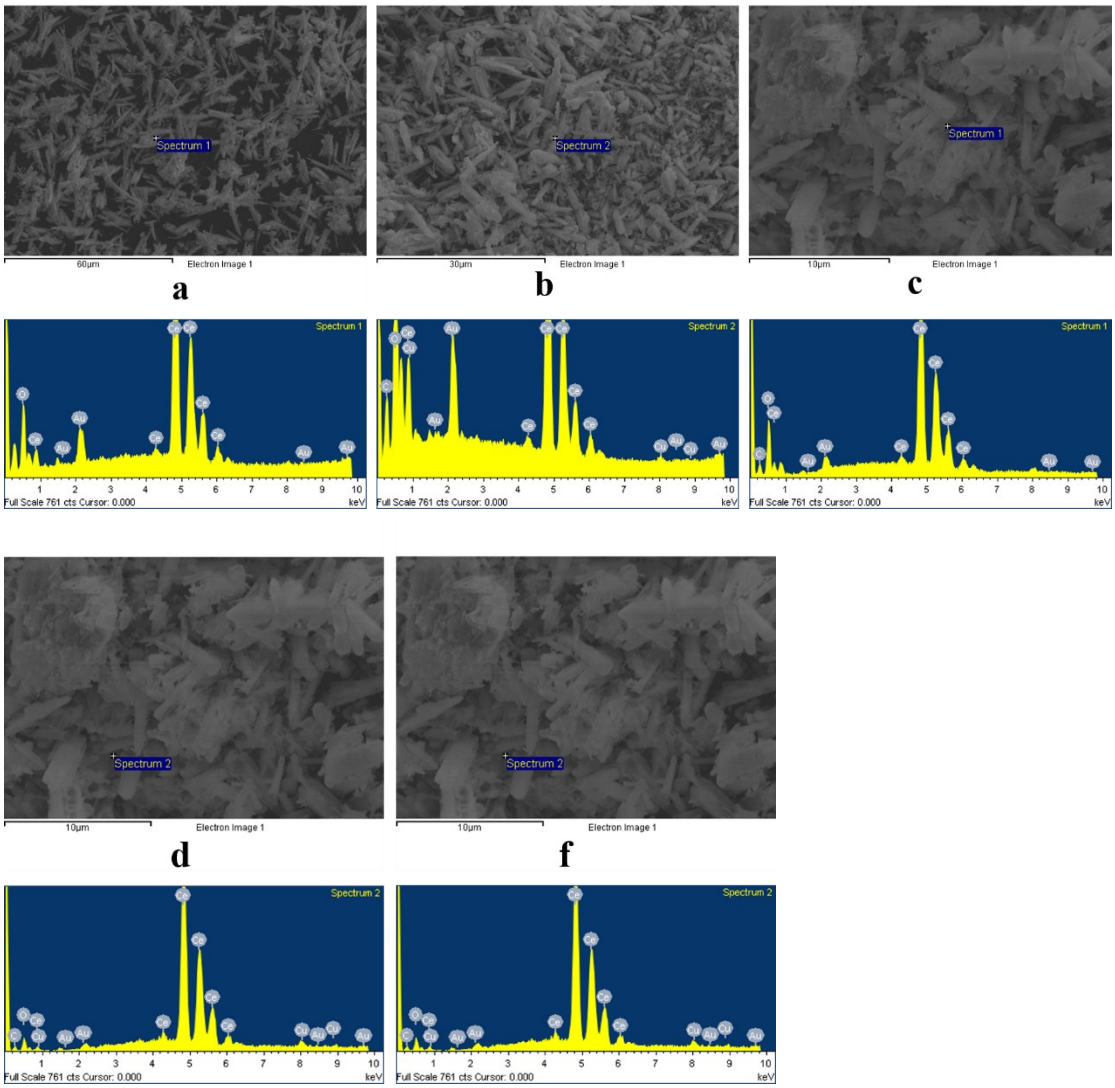

Fig. S4. EDS spectra of $Au@CeO_2$, $Au_8Cu_2@CeO_2$, $Au_5Cu_5@CeO_2$, $Au_1Cu_9@CeO_2$ and $Cu@CeO_2$.

Table S1. Ce, Au and Cu contents from EDS results.

EDS-Catalysts	$AuCeO_2$	$Au_8Cu_2CeO_2$	$Au_5Cu_5CeO_2$	$Au_1Cu_9CeO_2$	$Au_0Cu_{10}CeO_2$
Ce	87.3400	84.9600	88.7600	80.3400	88.5700
Au (x)	12.6600	5.9500	3.8200	3.1100	0.0000
Cu (y)	0.0000	9.0900	8.1300	11.4300	15.8400
y/(x+y) Theoretical/%	0.0000	20.0000	50.0000	90.0000	100.0000
y/(x+y) Virtual/%	0.0000	60.4300	68.0300	78.6100	100.0000

Table 2. Ce, Au and Cu contents from ICP results.

ICP-Catalysts	$AuCeO_2$	$Au_8Cu_2CeO_2$	$Au_5Cu_5CeO_2$	$Au_1Cu_9CeO_2$	$Au_0Cu_{10}CeO_2$
Au (x)	0.0498	0.0354	0.0245	0.0010	0.0000
Cu (y)	0.0000	0.0004	0.0007	0.0020	0.0308
Ce (z)	1.0250	0.9526	0.8378	1.0830	2.9460
y/(x+y)Theoretical/%	0.0000	20.0000	50.0000	90.0000	100.0000
y/(x+y)/Virtual/%	0.0000	0.0112	0.0278	0.6667	1.0000
x/(x+y+z)/%	4.6334	3.5815	2.8389	0.0921	0.0000
y/(x+y+z)/%	0.0000	0.0405	0.0811	0.1842	1.0347
z/(x+y+z)/%	95.3666	96.3780	97.0800	99.7238	98.9653

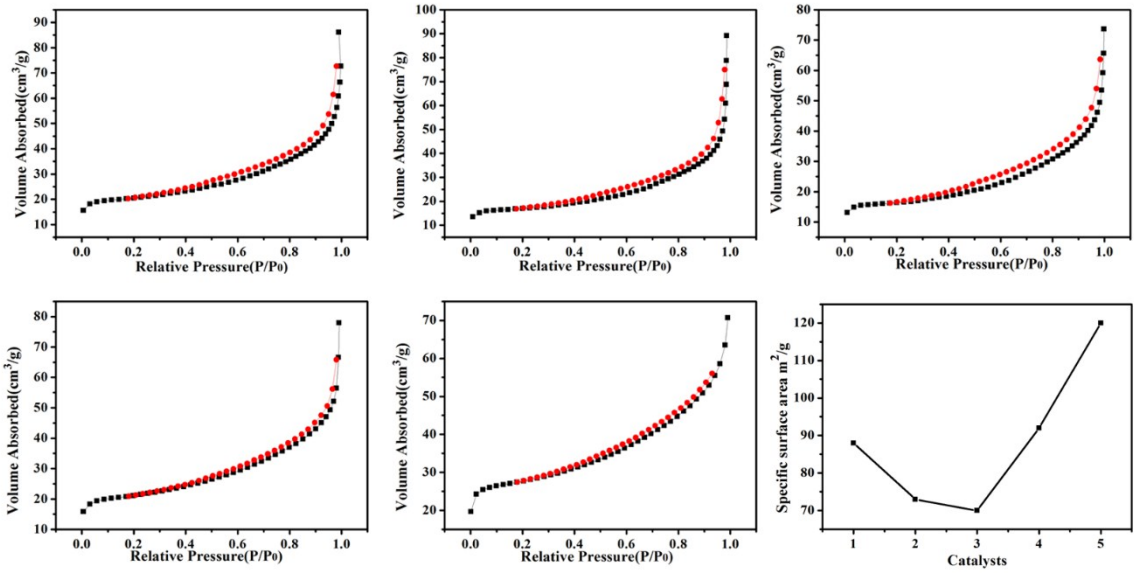

Fig. S5. Nitrogen adsorption-desorption curve and specific surface area.

Table S3. BET specific surface areas of the monometallic and bimetallic Au–Cu@CeO_2 nanocomposites

Catalysts	$AuCeO_2$	$Au_8Cu_2CeO_2$	$Au_5Cu_5CeO_2$	$Au_1Cu_9CeO_2$	$CuCeO_2$
Specific surface area (m^2/g^{-1})	88	73	70	92	120

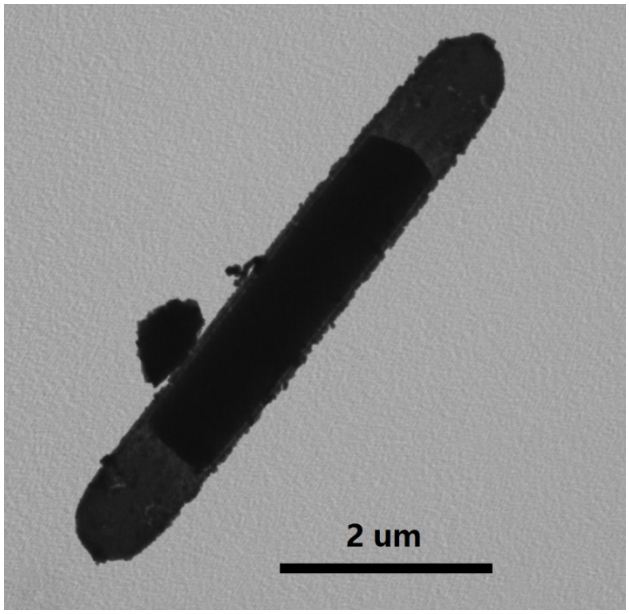

Fig. S6. TEM of $Au_1Cu_9@CeO_2$ after the long-running photocatalytic reaction.

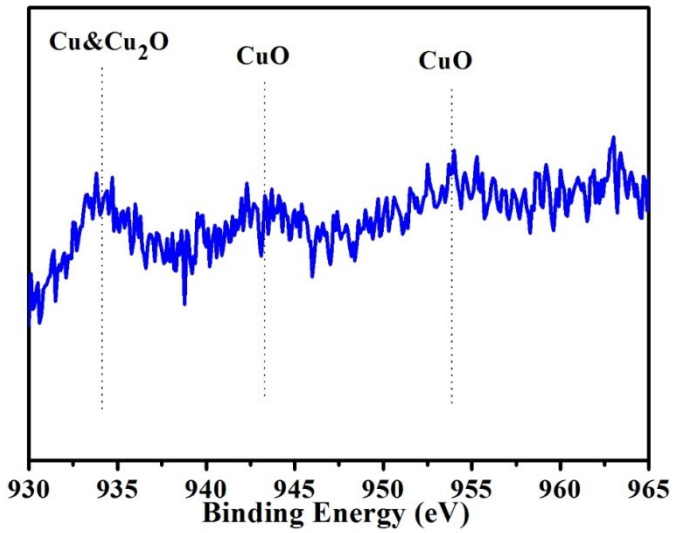

Fig. S7. Cu 2p of $Au_1Cu_9@CeO_2$ after photocatalytic oxidation.

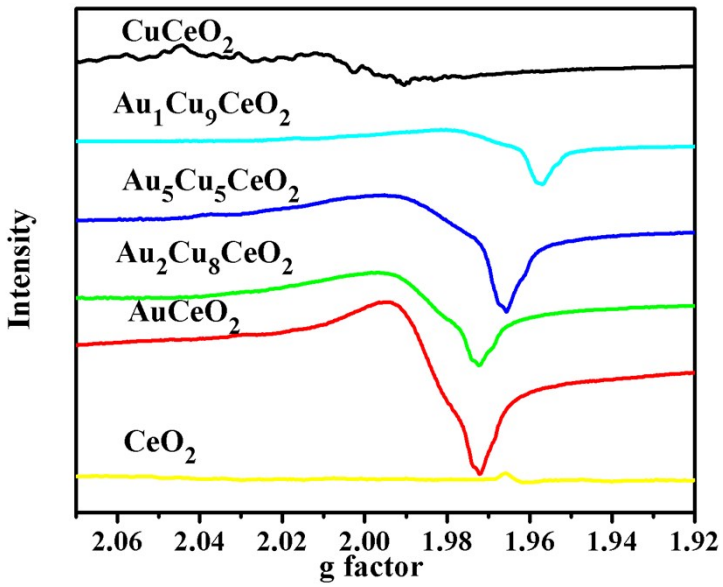

Fig. S8. ESR spectra of all the samples measured at room temperature in the dark (dashed line), and under the visible light illumination for 10 mins (solid line), respectively.