Electronic Supplementary Material (ESI) for RSC Advances.

Efficient Oxidation of Benzyl Alcohol into Benzaldehyde Catalyzed by Graphene Oxide and Reduced Graphene Oxide Supported Bimetallic Au–Sn Catalysts

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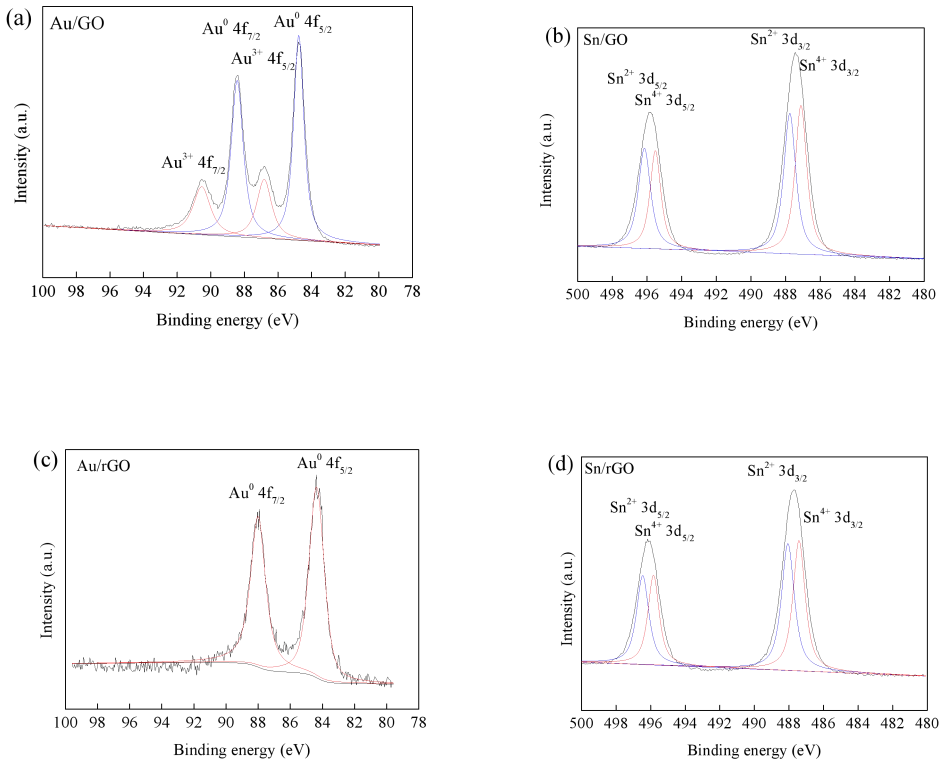

Fig. S1 Au 4f and Sn 3d XPS of the catalysts Au/GO (a), Sn/GO (b), Au/rGO (c) and Sn/rGO (d).

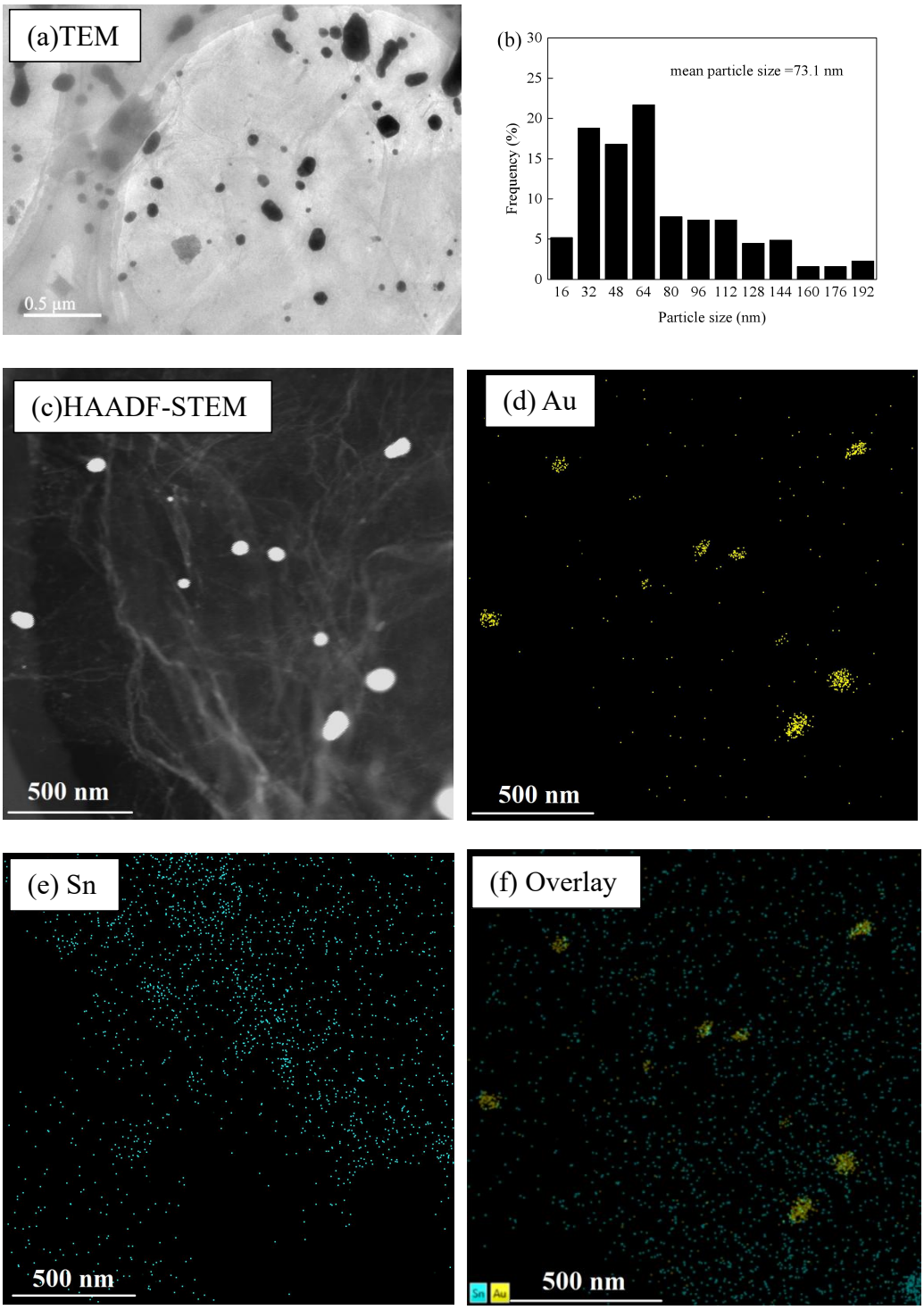

Fig. S2 (a) TEM micrograph of AuSn/GO-CoIM；(b) Au-Sn size distribution of AuSn/GO-CoIM; (c) HAADF-STEM micrograph; (d, e, f) EDS elemental mapping images micrographs of AuSn/GO-CoIM.

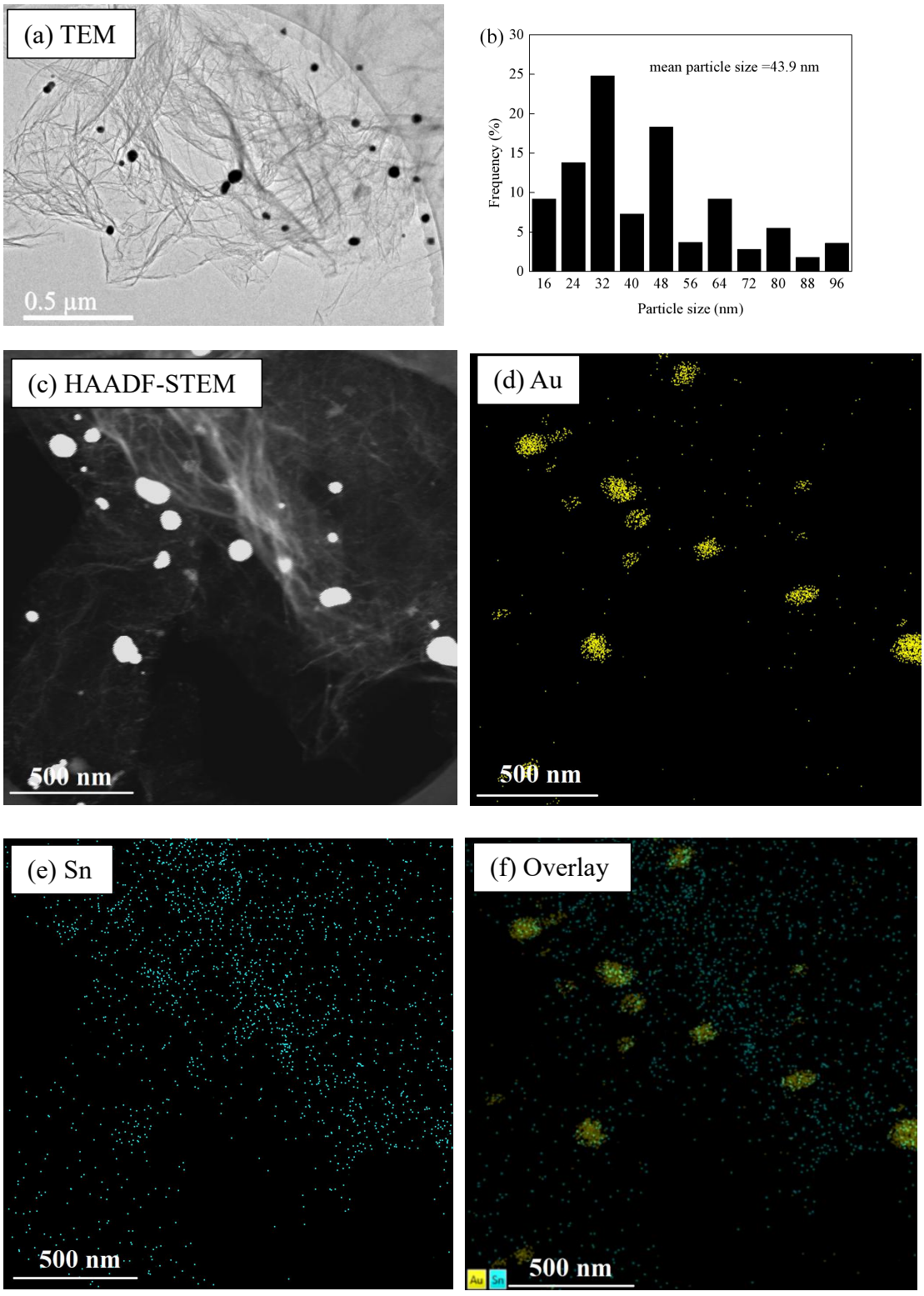

Fig. S3 (a) TEM micrograph of AuSn/rGO-CoIM；(b) Au-Sn size distribution of AuSn/rGO-CoIM; (c) HAADF-STEM micrograph; (d, e, f) EDS elemental mapping images micrographs of AuSn/rGO-CoIM.

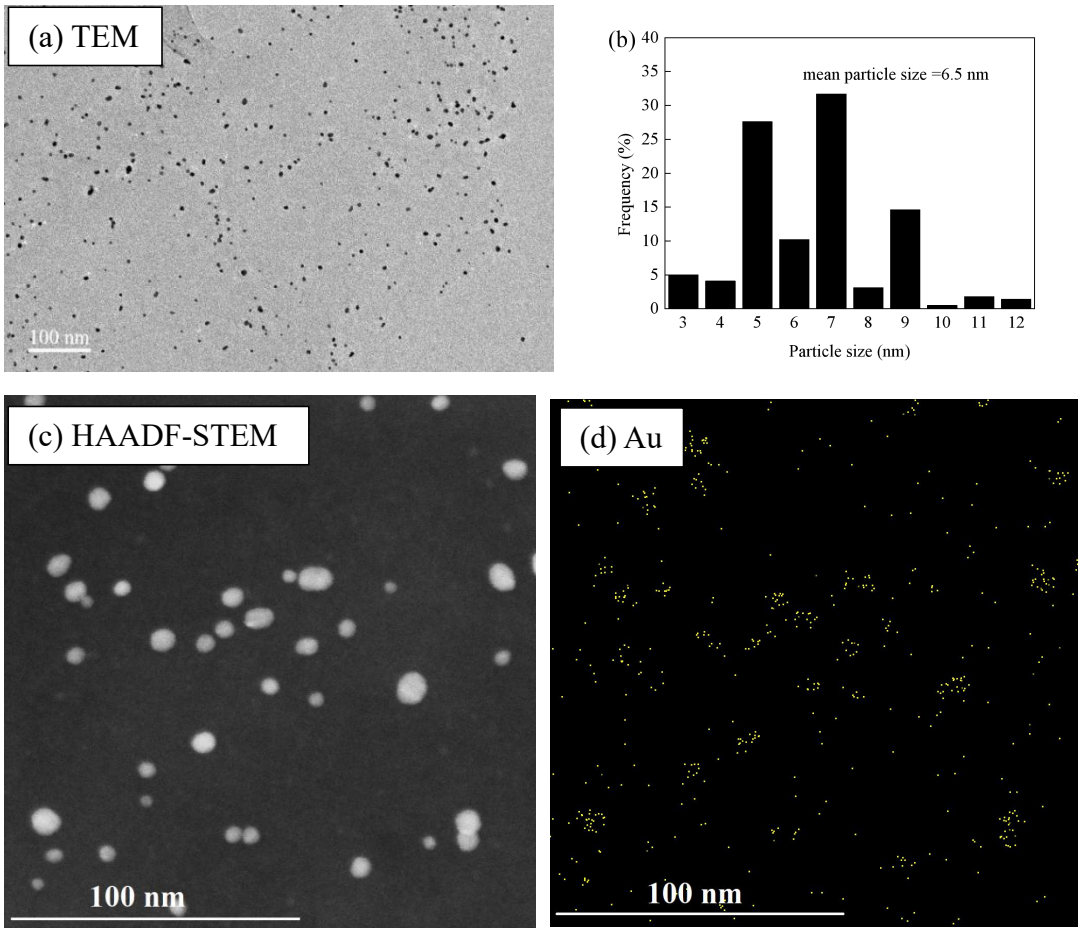

Fig. S4 (a) TEM micrograph of Au/GO；(b) Au size distribution of Au/GO; (c) HAADF-STEM micrograph; (d, e, f) EDS elemental mapping images micrographs of Au/GO.

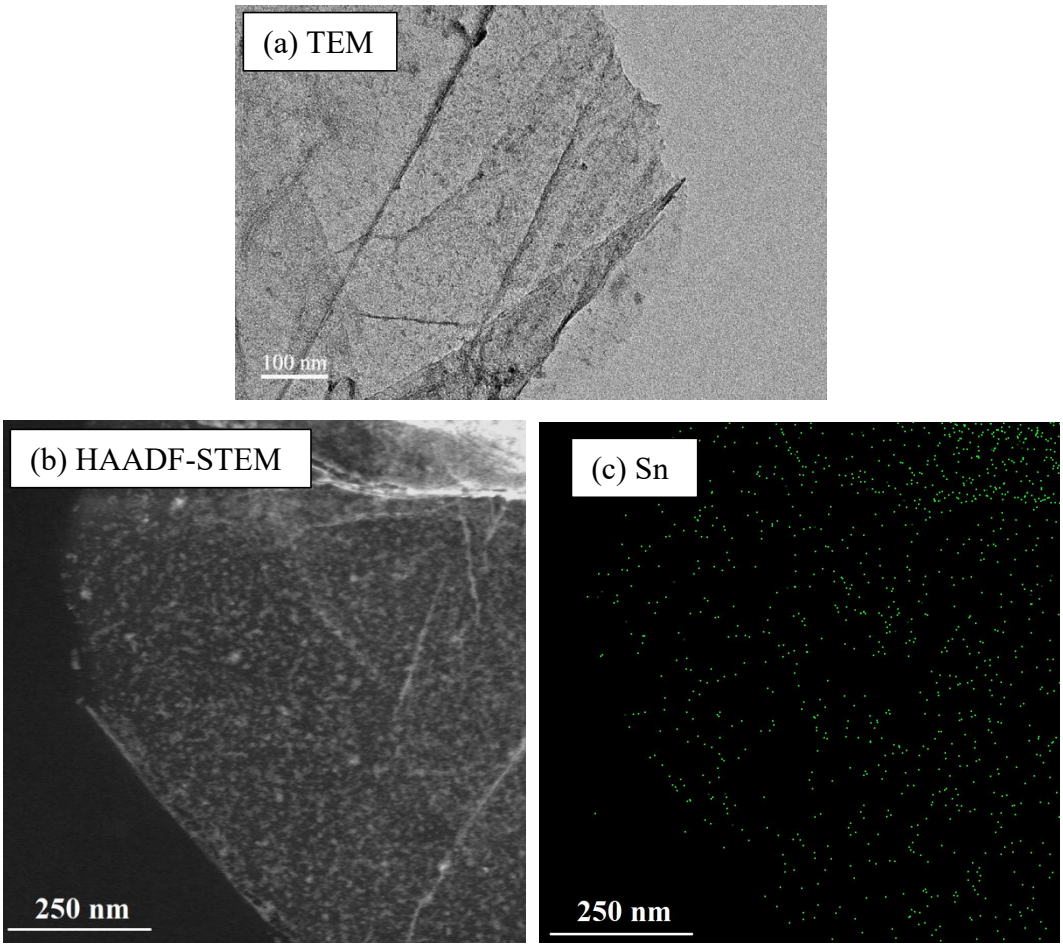

Fig. S5 (a) TEM micrograph of Sn/GO；(b) Au size distribution of Sn/GO; (c) HAADF-STEM micrograph; (d, e, f) EDS elemental mapping images micrographs of Sn/GO.

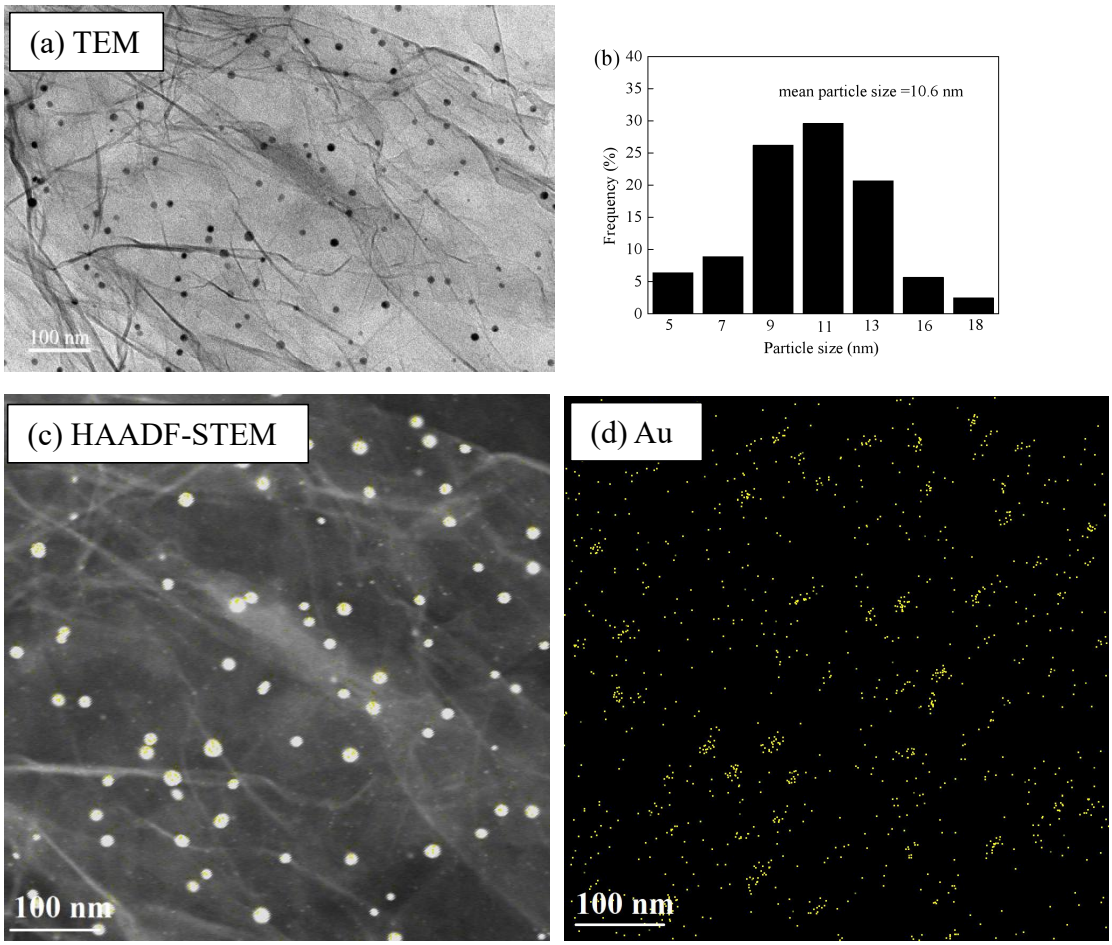

Fig. S6 (a) TEM micrograph of Au/rGO； (b) Au size distribution of Au/rGO; (c) HAADF-STEM micrograph; (d, e, f) EDS elemental mapping images micrographs of Au/rGO.

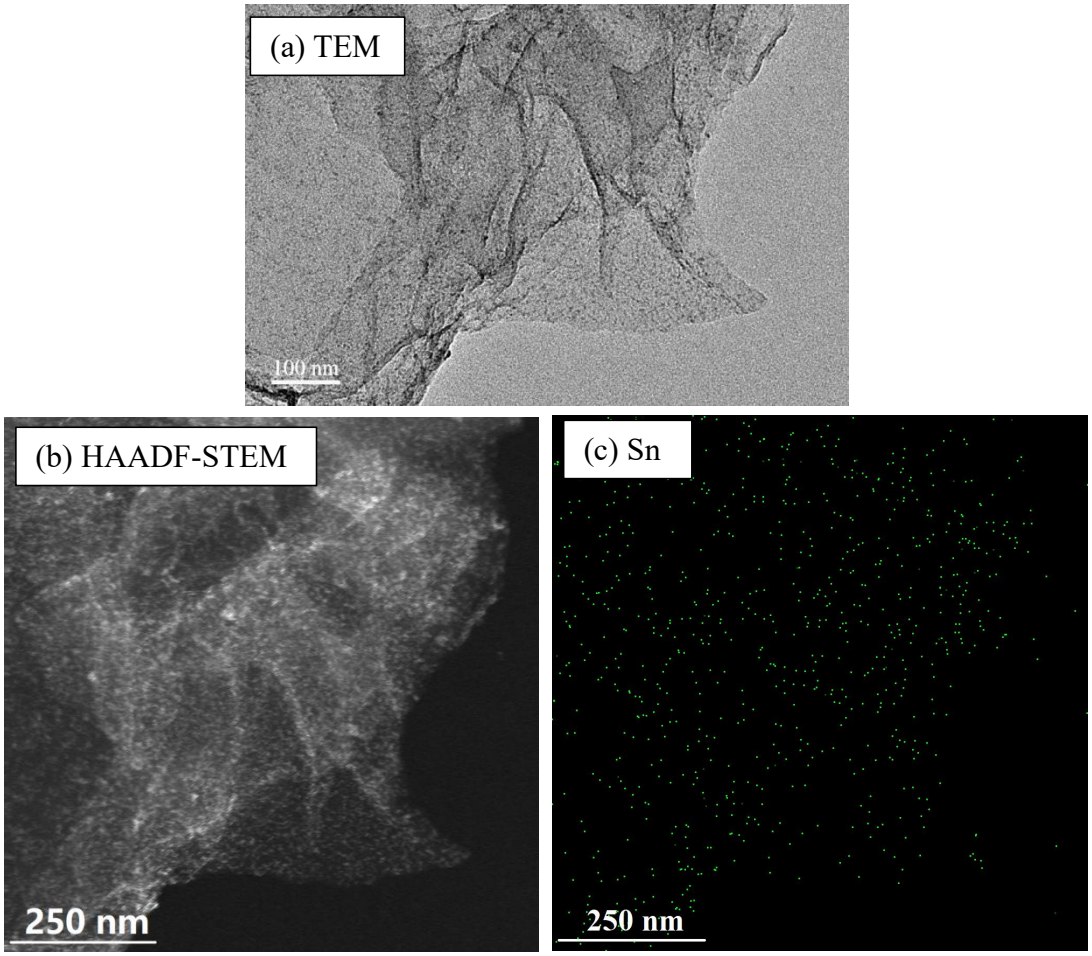

Fig. S7 (a) TEM micrograph of Sn/rGO；(b) Au size distribution of Sn/rGO; (c) HAADF-STEM micrograph; (d, e, f) EDS elemental mapping images micrographs of Sn/rGO.

Table S1 The BzOH conversions and BzH selectivities, and BzH yields during the selective oxidation of BzOH on AuSn/GO-CoIM and AuSn/rGO-CoIM catalysts[a]

Entry	Catalyst	Solvent	T (℃)	Pressure (bar)	Time (h)	Conv. (%)	S (%)	Yield (%)	TOF (h^{-1})
1	AuSn/GO-CoIM	THF	90	5	2	73.5	43.8	32.2	54.8
2	AuSn/GO-CoIM	acetonitrile	90	5	2	17.6	27.5	4.8	13.1
3	AuSn/GO-CoIM	DMF	90	5	2	9.0	93.4	8.4	6.7
4	AuSn/GO-CoIM	1,4-dioxane	90	5	2	45.8	29.8	13.6	34.2
5	AuSn/GO-CoIM	THF	80	5	2	28.9	12.2	3.5	21.6
6	AuSn/GO-CoIM	THF	100	5	2	90.8	18.0	16.3	67.8
7	AuSn/GO-CoIM	THF	90	3	2	64.8	60.5	39.2	48.4
8	AuSn/GO-CoIM	THF	90	8	2	83.3	34.2	28.5	62.2
9	AuSn/GO-CoIM	THF	90	3	1	30.2	60.5	18.3	45.1
10	AuSn/rGO-CoIM	THF	100	3	2	73.3	45.7	33.5	62.5
11	AuSn/rGO-CoIM	acetonitrile	100	3	2	2.6	99.0	2.6	2.2
12	AuSn/rGO-CoIM	DMF	100	3	2	32.9	0	0	28.1
13	AuSn/rGO-CoIM	1,4-dioxane	100	3	2	26.8	22.0	5.9	22.9
14	AuSn/rGO-CoIM	THF	80	3	2	14.4	6.3	0.9	12.3
15	AuSn/rGO-CoIM	THF	90	3	2	62.0	46.3	28.7	52.9
16	AuSn/rGO-CoIM	THF	110	3	2	84.3	35.4	29.8	45.1
17	AuSn/rGO-CoIM	THF	100	1	2	50.1	29.4	13.3	42.7
18	AuSn/rGO-CoIM	THF	100	5	2	72.9	20.8	15.1	62.2
19	AuSn/rGO-CoIM	THF	100	3	1	65.9	45.8	30.2	112.4
20	AuSn/rGO-CoIM	THF	100	3	4	85.9	25.4	21.8	36.6

[a] Reaction conditions: BzOH (1.0 mmol), solvent (7.0 mL), catalyst (15.0 mg).

Table S2 The BzOH conversions, BzH selectivities, and BzH yields during the selective oxidation of BzOH on AuSn/GO-TS and AuSn/rGO-TS nanocatalysts[a]

Entry	Catalyst	Solvent	T (℃)	Pressure (bar)	Time (h)	Conv. (%)	S (%)	Yield (%)	TOF (h^{-1})
1	Au/GO	THF	90	3	1	59.4	71.4	42.4	39.8
2	Au/GO	Acetonitrile	90	3	1	2.2	99.0	2.2	1.5
3	Au/GO	DMF	90	3	1	1.0	99.0	1.0	0.7
4	Au/GO	1,4-dioxane	90	3	1	9.4	99.0	9.3	6.3
5	Au/GO	THF	90	3	2	64.3	60.2	38.7	21.5
6	Au/GO	THF	90	3	3	92.3	30.8	28.4	20.6
7	Au/GO	THF	80	3	1	36.0	86.4	31.1	24.1
8	Au/GO	THF	100	3	1	96.5	36.6	35.3	64.7
9	Au/GO	THF	90	1	1	3.5	99.5	3.5	2.3
10	Au/GO	THF	90	5	1	73.1	36.7	26.8	49.0
11	Sn/GO	THF	90	3	2	1.6	99.0	1.6	0.5
12	Sn/GO	THF	90	3	3	2.3	99.0	2.3	0.5
13	Sn/GO	THF	100	3	2	6.2	99.0	6.1	2.1
14	Sn/GO	THF	100	1	2	4.9	99.0	4.9	1.6
15	Sn/GO	THF	100	5	2	9.5	85.5	8.1	3.2
16	Au/rGO	THF	100	3	2	76.2	50.4	38.4	25.3
17	Au/rGO	Acetonitrile	100	3	2	3.1	81.5	2.5	30.5
18	Au/rGO	DMF	100	3	2	38.7	0	0	15.5
19	Au/rGO	1,4-dioxane	100	3	2	29.7	5.7	1.7	11.9
20	Au/rGO	THF	100	3	1	55.0	55.8	30.7	44.0
21	Au/rGO	THF	100	3	3	98.2	33.0	32.4	26.2
22	Au/rGO	THF	90	3	2	17.3	98.4	17.0	6.9
23	Au/rGO	THF	110	3	2	81.5	31.2	25.4	32.6
24	Au/rGO	THF	100	1	2	5.0	98.9	4.9	2.0
25	Au/rGO	THF	100	5	2	95.4	14.0	13.4	38.2
26	Sn/rGO	THF	100	3	2	16.4	100	16.4	6.1

[a] Reaction conditions: BzOH (1.0 mmol), solvent (7.0 mL), catalyst (15.0 mg).