Supporting Information

Synergistic Catalysis in SiO_2 Supported Ir-Sn bimetallic Nanoparticles for Selective Hydrogenation of Aromatic Ketone to Aromatic Alcohol

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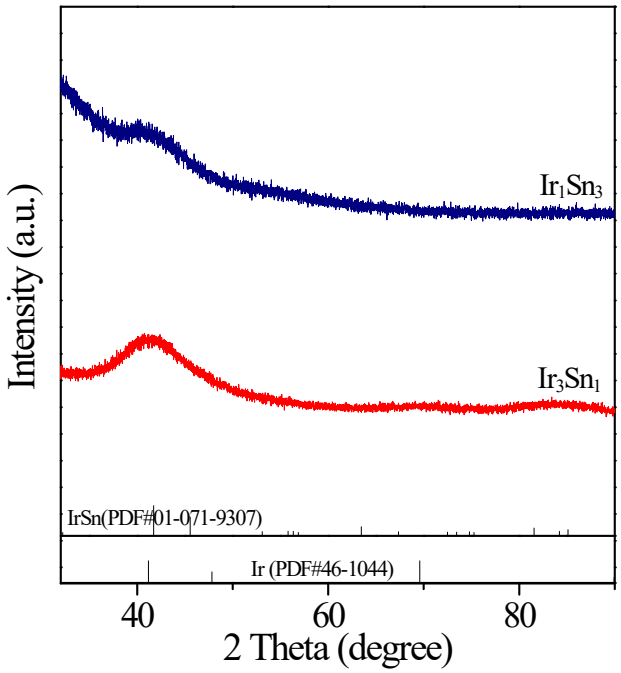

Figure S1. Powder X-ray diffraction (PXRD) pattern of as-prepared Ir_3Sn_1 and Ir_1Sn_3 NPs.

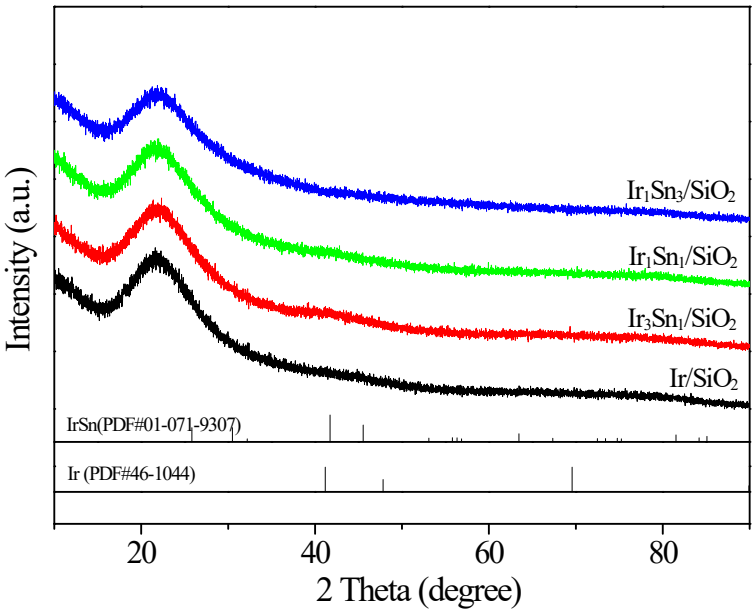

Figure S2. XRD patterns of Ir/SiO_2, Ir_3Sn_1/SiO_2, Ir_1Sn_1/SiO_2, and Ir_1Sn_3/SiO_2.

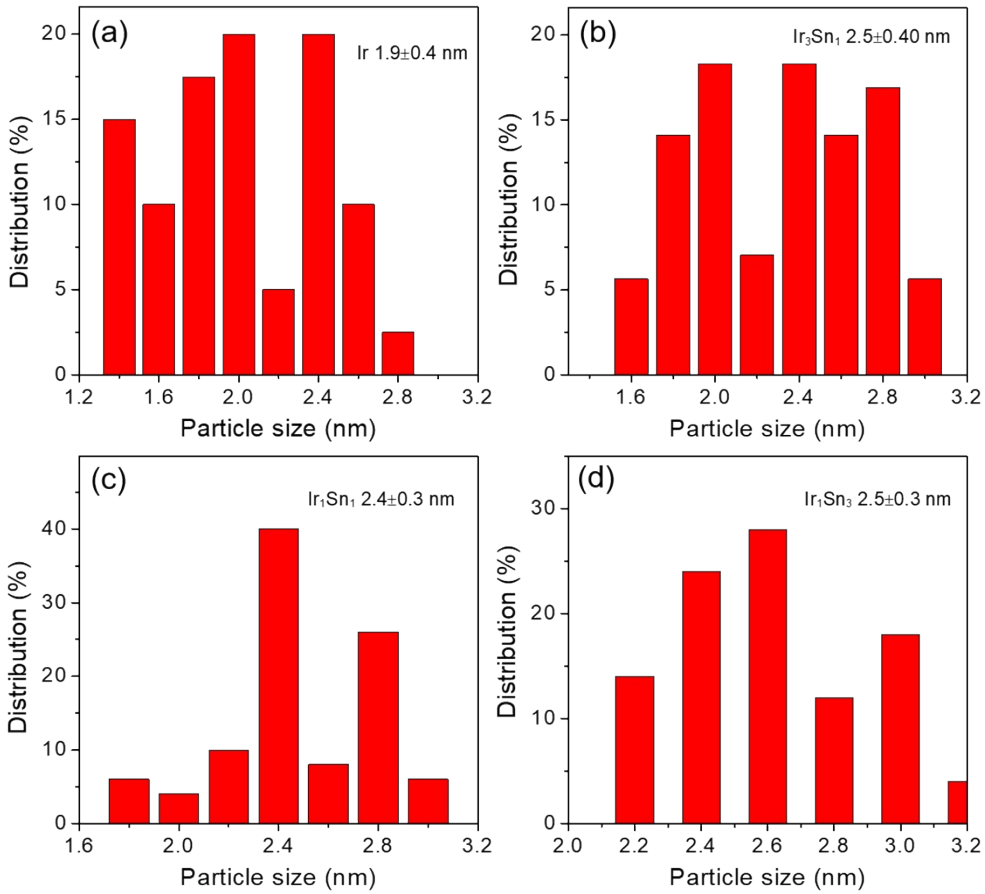

Figure S3. Size distributions showing: a) Ir NPs, b) Ir_3Sn_1 NPs, c) Ir_1Sn_1 NPs, and d) Ir_1Sn_3 NPs.

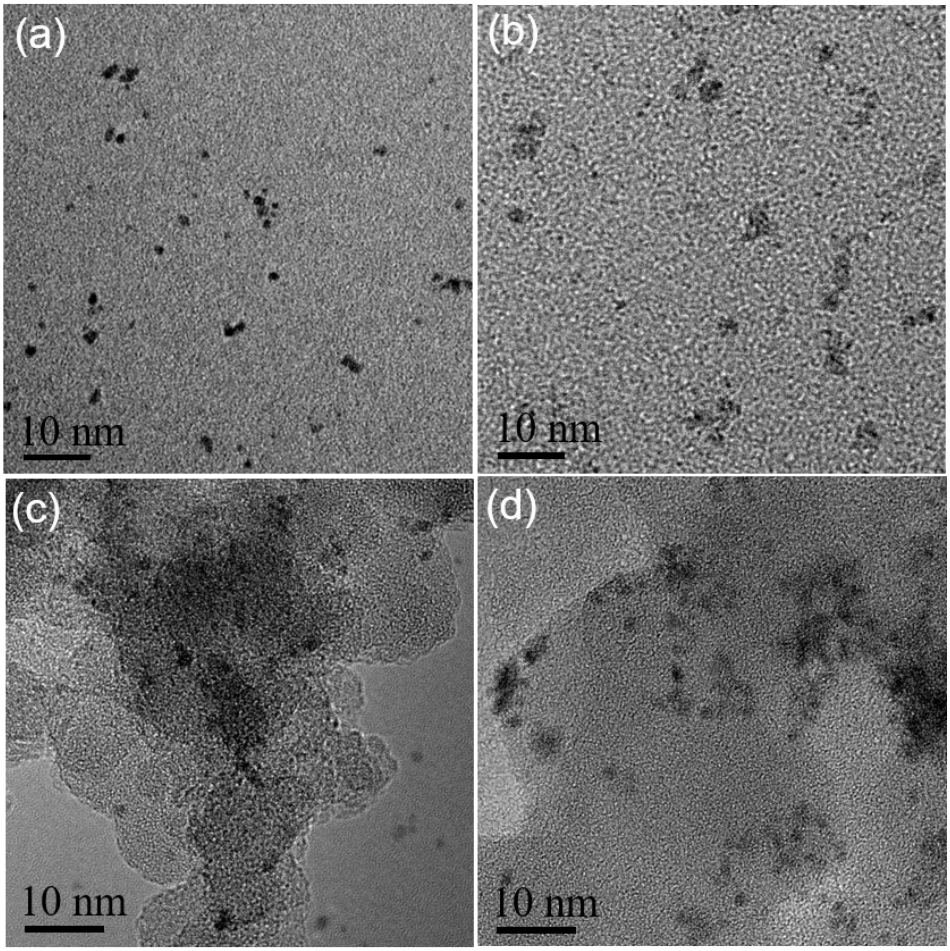

Figure S4. TEM images of Ir_3Sn_1 NPs, Ir_1Sn_3 NPs, Ir_3Sn_1/SiO_2, and Ir_1Sn_3/SiO_2 nanocatalysts.

Table S1. Atomic ratios of Sn and Ir with different oxidation states from the XPS analysis for Ir/SiO_2 and Ir_1Sn_1/SiO_2 nanocatalysts.

Samples	Ir/Oxidized Ir	Sn/Oxidized Sn
Ir/SiO_2	80.7/19.3	-
Ir_3Sn_1/SiO_2	83.4/16.6	71.6/28.4
Ir_1Sn_1/SiO_2	83.5/16.5	85.3/14.7
Ir_1Sn_3/SiO_2	82.6/17.4	87.1/12.9

Table S2 Comparison of catalytic performance of $IrSn/SiO_2$ and previously reported heterogeneous catalysts for the selective hydrogenation of acetophenone.

Cat.	Solvent	Temperature [°C]	H_2 [MPa]	Selectivity [%]	TOF[a] [h^{-1}]	Ref.
$IrSn/SiO_2$	Ethanol	60	1	95.9	20.3	This work
Ir/CeO_2	1,4-dioxane	30	1	72	~18.0	S1
Ir/C	isopropanol/water	80	1	96	1.9	S2
Ir-NC/MNC-800	isopropanol/water	80	1	97	2.57	S2
Ir_5-$(SnO_2)_1/SiO_2$	Ethanol	45	1	99	14.2	S3
Ir_2/MgO	isopropanol	70	Atmospheric pressure	-	5	S4
Pt_5Ru_1/NH_2-rGO	THF	130	5	96	8.8	S5
Pt/Al_2O_3	Methanol	25	0.6	93.3	14.1	S6
Ag-OMS-2	Isopropyl alcohol	140	2.5	100	18.4	S7
cubic Pd/NiO	Ethanol	80	1.5	89	8.3	S8
Co/mordenite	Water	90	2	98.6	2.9	S9

[a]The turnover frequency (TOF) is measured as moles of products per total molar metal atoms per hour.

References

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S9 Zhang, X.B.; Lu, W.N.; Wang, J.L.; Liao, B.H.; Qin, Y.H.; Zhang, Y.J.; Zhang, B.; Xin, S. Selective Catalytic Hydrogenation of Acetophenone to 1-Phenylethanol over Co/mordenite in Water. *Catal. Commun.* **2019,** *119,* 124-128.

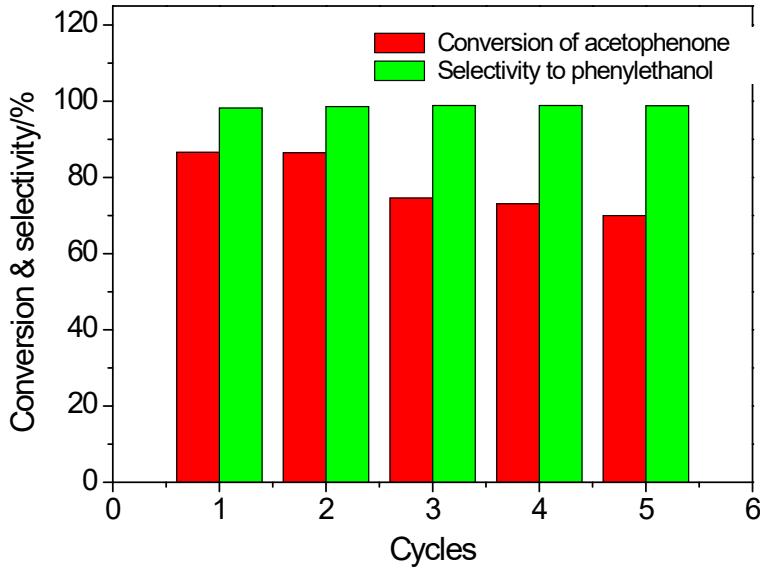
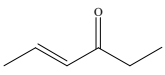
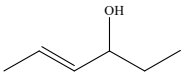
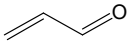
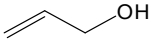
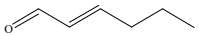
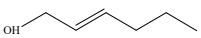


Figure S5. Recycling stability of $IrSn/SiO_2$ in the hydrogenation of acetophenone.

Table S3. Catalytic hydrogenations of various unsaturated aldehydes and ketones over Ir_1Sn_1/SiO_2 nanocatalysts.

Entry	Substrates	Products	Time [h]	Samples	Conv. [%]	Sel. [%]
1			12	Ir_1-Sn_1/SiO_2	100.0	72.0
2 [a]			12	Ir_1-Sn_1/SiO_2	100.0	89.3
3 [a]			12	Ir_1-Sn_1/SiO_2	100.0	90.7

Reaction conditions: reactants, 0.5 mmol; reaction temperature, 80 °C; ethanol, 5.0 mL; H_2 pressure, 1.0 MPa; speed of agitation, 700 rpm/min; N-nonane 0.5 mmol and catalysts-0.0500 g.