

# Synthesis of Pt<sub>3</sub>Sn Catalyst Using Solvothermal Method Assisted by Deep Eutectic Solvents for Selective Hydrogenation of Furfural to Furfuryl Alcohol

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**Table S1.** Physicochemical properties of Pt-Sn catalysts with different synthesis

Samples	S <sub>BET</sub> (m <sup>2</sup> /g)
PtSn <sub>0.5</sub> /CNTs-60	146.6
PtSn <sub>0.5</sub> /CNTs-80	148.5
PtSn <sub>0.5</sub> /CNTs-100	142.1
PtSn <sub>0.5</sub> /CNTs-140	135.4
PtSn <sub>0.5</sub> /CNTs-180	143.1

temperature

**Table S2.** Physicochemical properties of Pt-Sn catalysts with different Pt/Sn ratio

Samples	S <sub>BET</sub> (m <sup>2</sup> /g)
CNT	144.5
Pt/CNTs	147.3
PtSn <sub>0.2</sub> /CNTs-100	142.4
PtSn <sub>0.5</sub> /CNTs-100	142.1
PtSn <sub>1.0</sub> /CNTs-100	138.4
PtSn <sub>2.0</sub> /CNTs-100	120.9

**Table S3.** The calculated charge transfers between Pd and Sn in Pt<sub>3</sub>Sn unit cell.

Atom	Pt(1)	Pt(2)	Pt(3)	Sn(1)
Charge transfer (e) <sup>a</sup>	0.413	0.326	0.470	-1.209

a. “-” means getting electrons

**Table S4.** FAL hydrogenation to FOL over different Pt-Sn catalysts.

Entry	Catalyst	T (°C)	Time (h)	Pressure (MPa)	Con. (%)	Sel. (%)	Ref.
1	Pt-Sn/SiO <sub>2</sub>	100	5	20	47	100	[1]
2	Pt-Sn@mSiO <sub>2</sub>	160	- <sup>a</sup>	1	99	97	[2]
3	PtSn <sub>0.2</sub> /SiO <sub>2</sub>	100	8	10	100	96	[3]
4	PtSn <sub>0.8</sub> /SiO <sub>2</sub>	100	8	10	71	98	[3]
5	Pt <sub>1</sub> Sn <sub>0.3</sub> /HMSNs	100	5	10	99	98	[4]
6	Pt-Sn/SiO <sub>2</sub>	100	5	20	63	99	[5]
7	PtSn <sub>0.10</sub> @UiO-66-NH <sub>2</sub>	160	10	-	60	98	[6]
8	PtSn <sub>0.5</sub> /CNTs-100	80	6	20	>99	>99	This work

<sup>a</sup> performed in a fixed-bed reactor.

**Table S5.** Calculated  $k$  of FAL hydrogenation over Pt/CNTs-100 and PtSn<sub>0.5</sub>/CNTs-100 under different temperature.

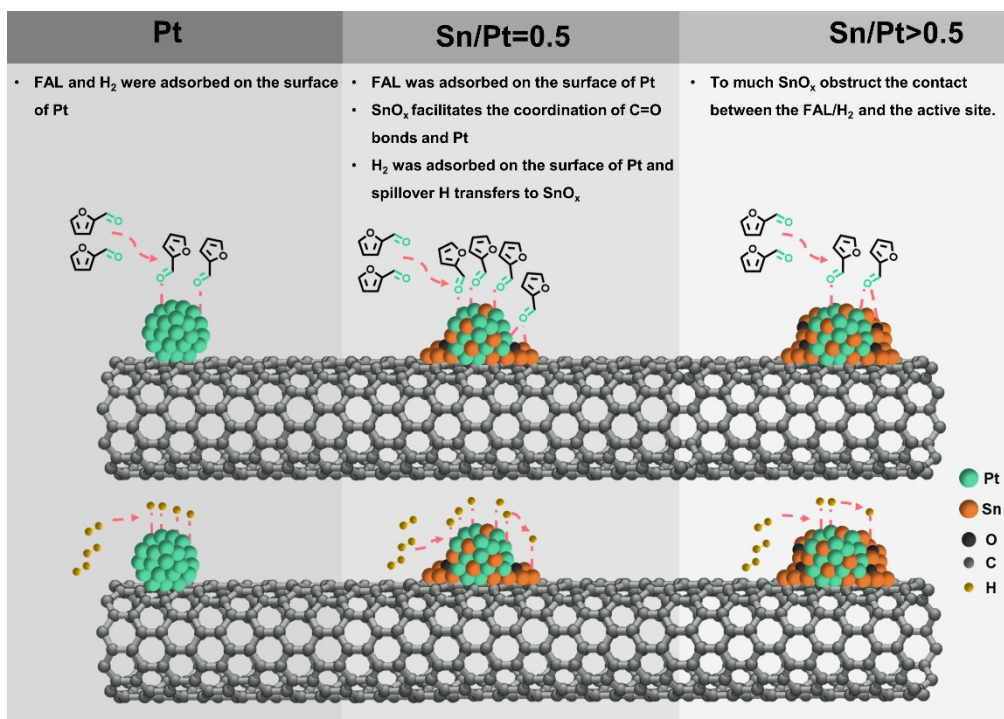
Catalyst	T/K	k(min <sup>-1</sup> )	R <sup>2</sup>
Pt/CNTs-100	313.15	0.00072	0.99
	323.15	0.00119	0.99
	333.15	0.00172	0.99
	353.15	0.00313	0.99
PtSn <sub>0.5</sub> /CNTs-100	313.15	0.000904	0.99
	323.15	0.001418	0.99
	333.15	0.001812	0.99
	353.15	0.002997	0.98



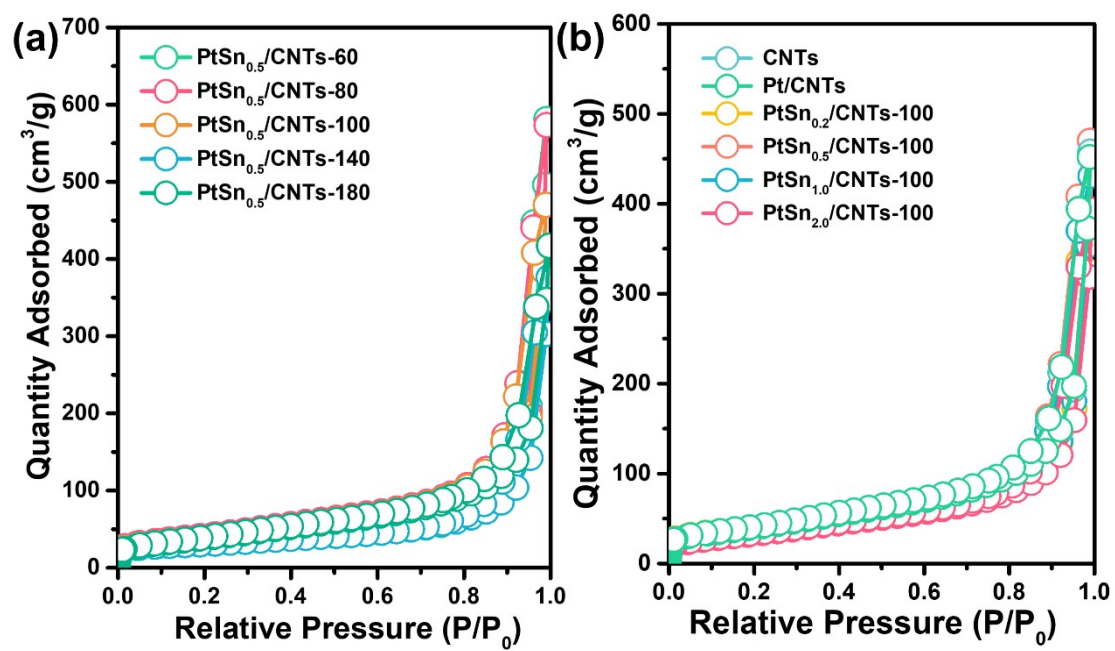
**Table S6.** Hydrogenation of FAL over different catalysts.

Entry	Con.% <sup>a</sup>	Sel.% <sup>a</sup>				
		FOL	THFOL	2-MF	2-MTHF	Unknown chemicals <sup>b</sup>
1	96.9	99.4	0	0	0	0.6
2	95.9	97.9	1.2	0	0	0.9
3	95.9	96.1	2.7	0	0	1.2
4	95.5	95.7	2.9	0.6	0	0.8
5	96.9	94.3	3.8	1.2	0	0.7
6	94.9	91.2	4.7	2.2	0	1.9
7	96.0	91.7	5.5	1.4	0	1.4
8	94.0	90.4	6.3	2.3	0	1.0
9	92.9	90.6	6.4	1.2	0	1.8
10	91.7	86.9	9.6	1.5	0	2.0

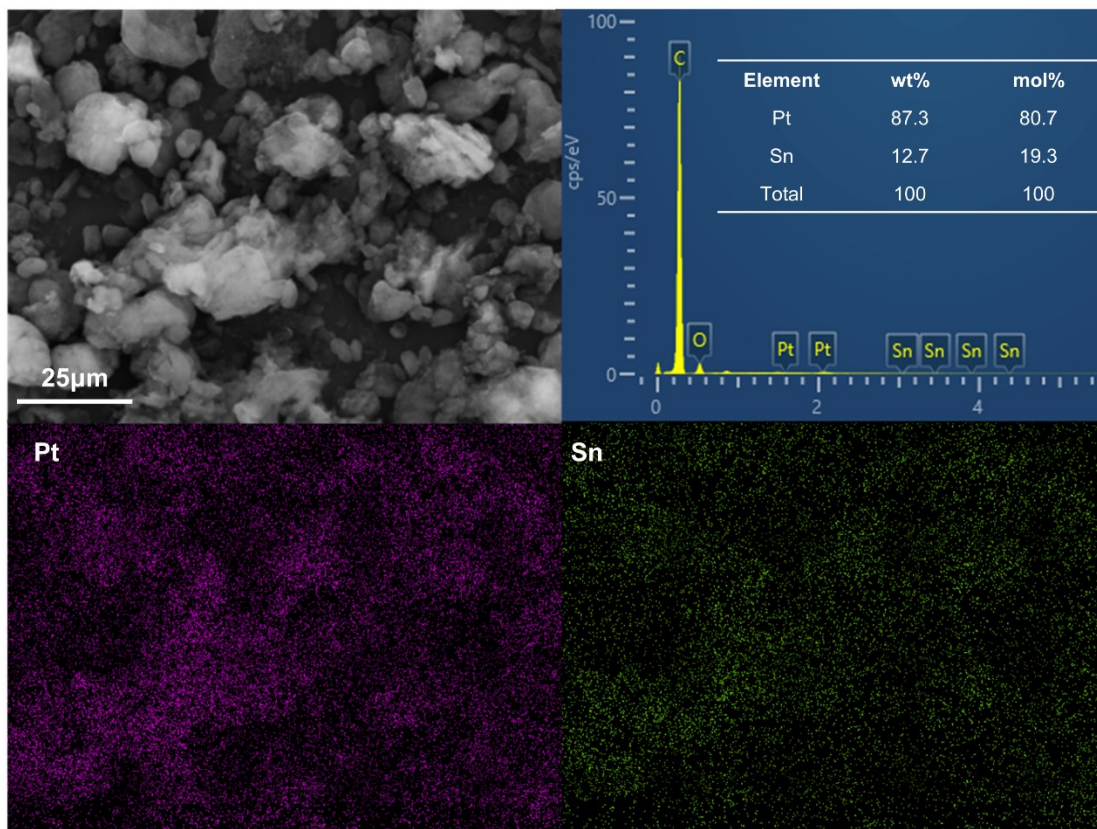
<sup>a</sup>Reaction conditions: 80 °C, 2 MPa, 4 h, 50 mg catalyst, and H<sub>2</sub>O as solvent. <sup>b</sup>Calculated by carbon balance.



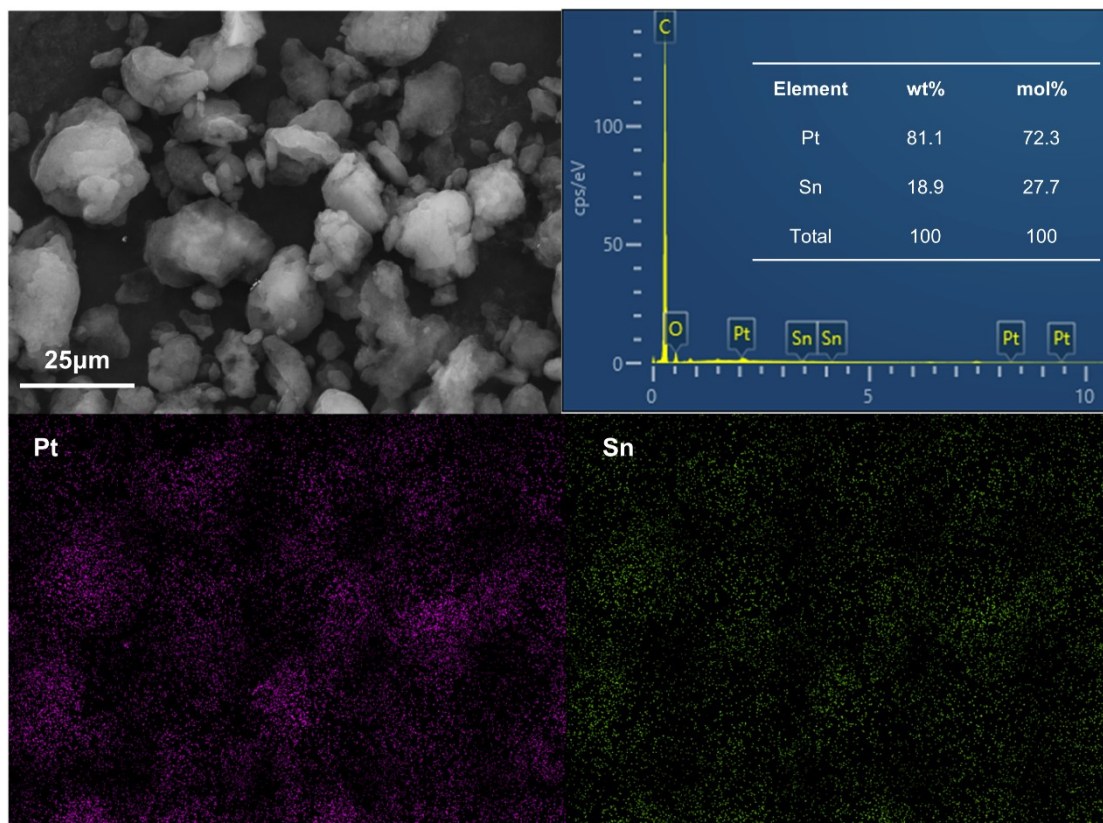
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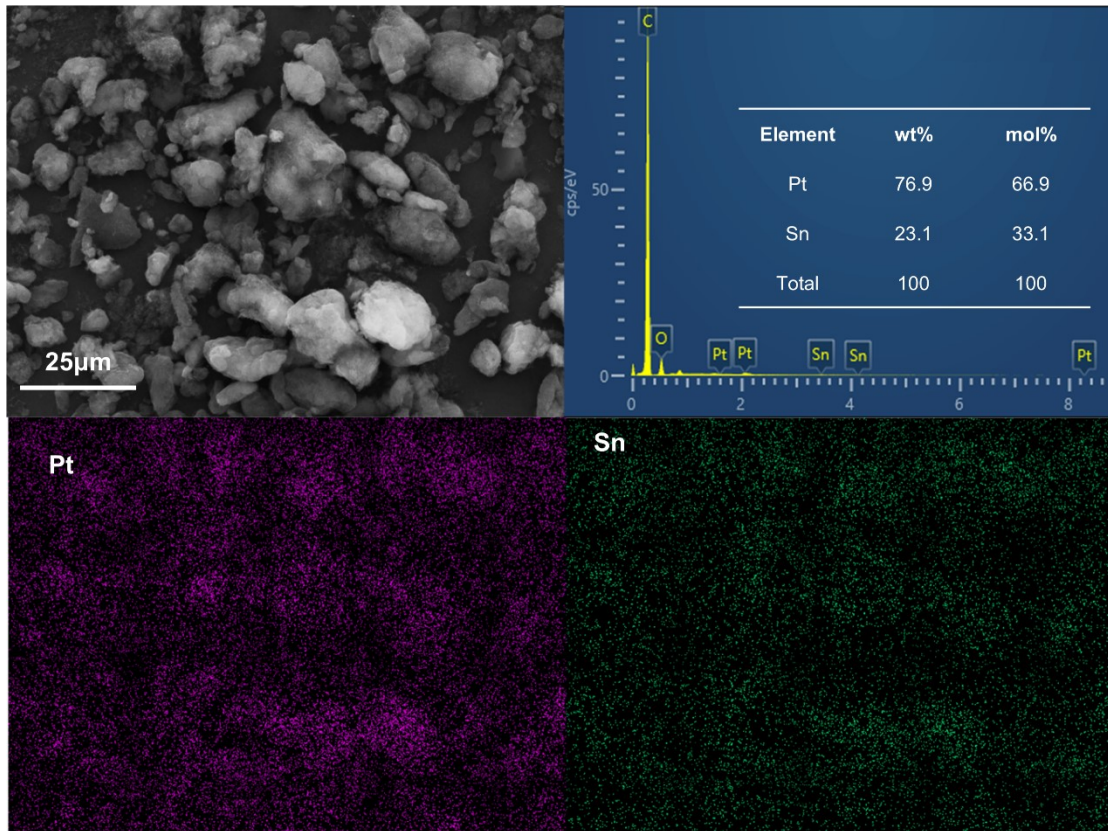


**Fig. S2** SEM image and the corresponding elemental EDX mapping of PtSn<sub>0.2</sub>/CNTs-



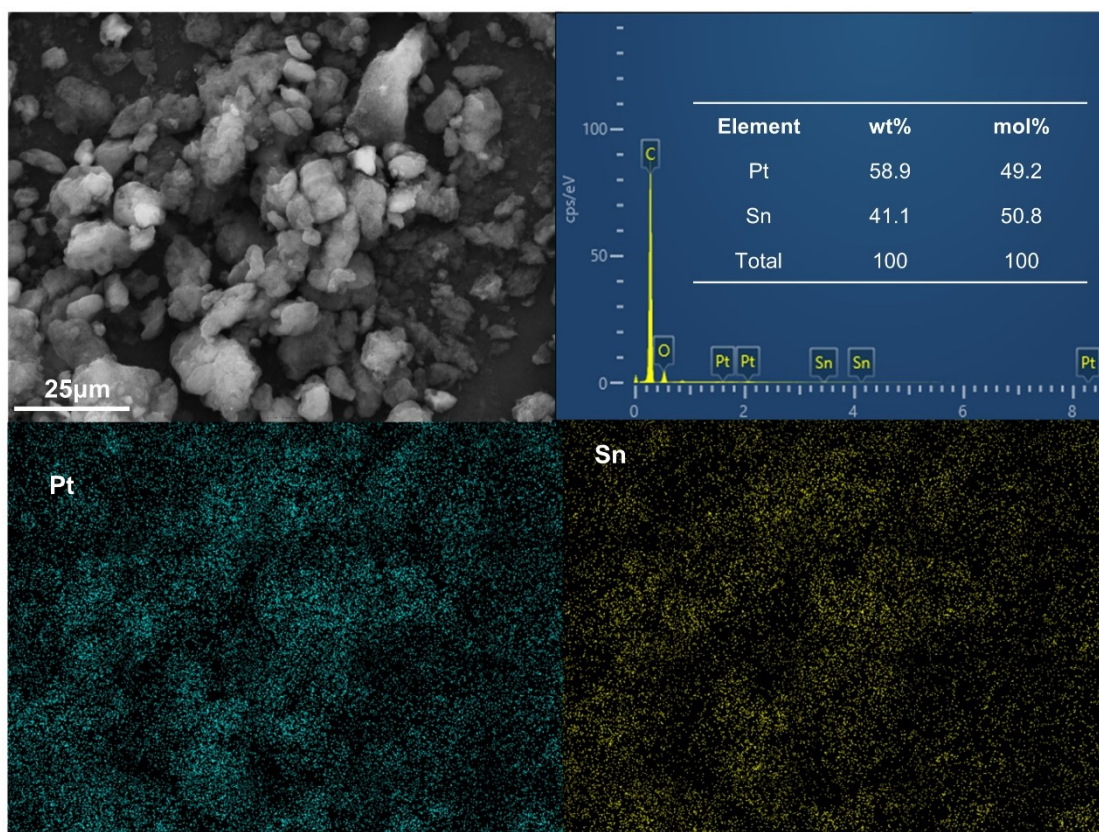
**Fig. S3** SEM image and the corresponding elemental EDX mapping of PtSn<sub>0.33</sub>/CNTs-

100



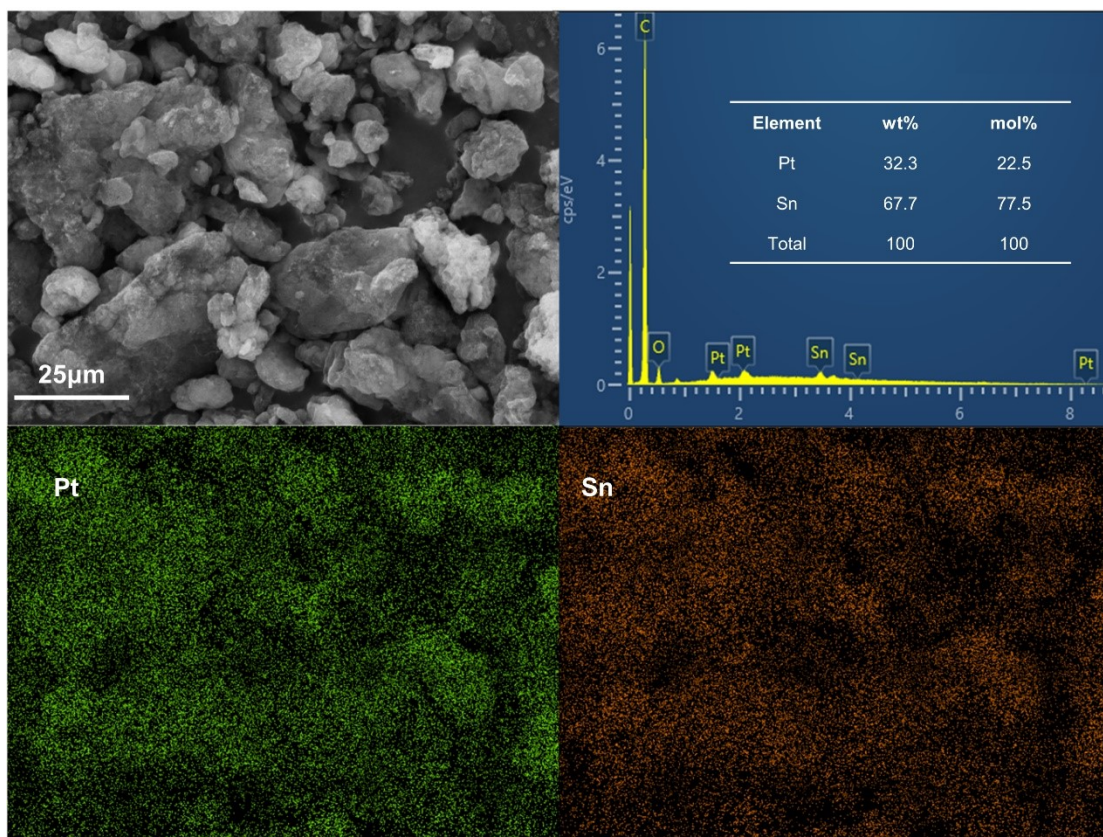
**Fig. S4** SEM image and the corresponding elemental EDX mapping of PtSn<sub>0.5</sub>/CNTs-

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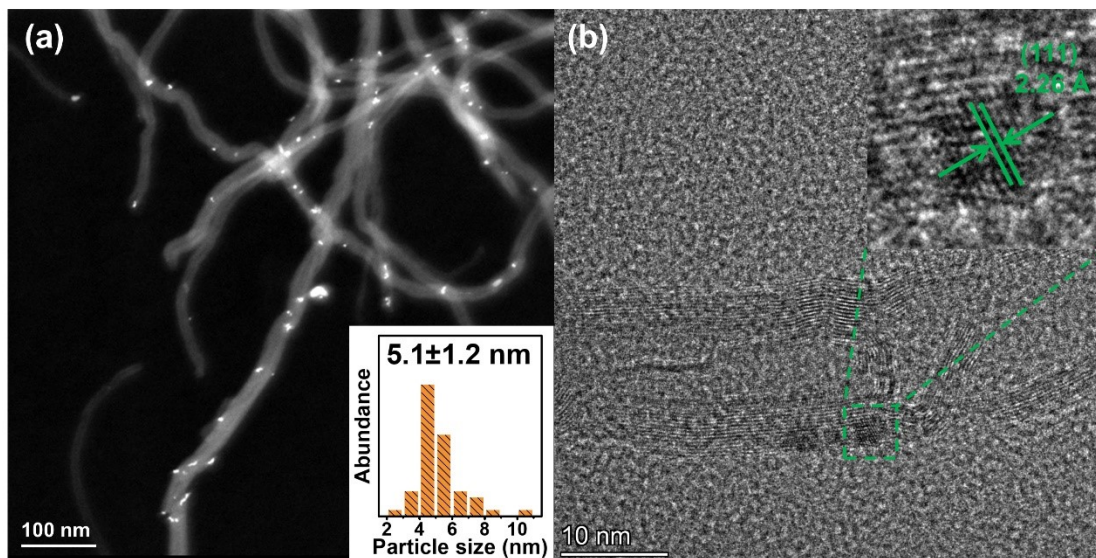
**Fig. S5** SEM image and the corresponding elemental EDX mapping of PtSn<sub>1.0</sub>/CNTs-

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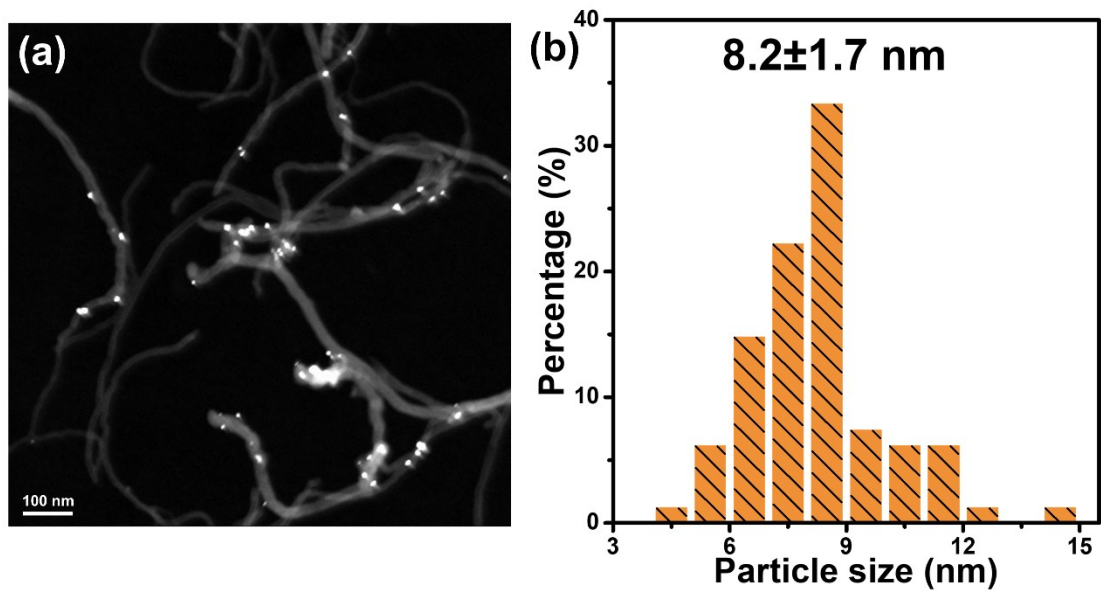


**Fig. S6** SEM image and the corresponding elemental EDX mapping of PtSn<sub>2.0</sub>/CNTs-

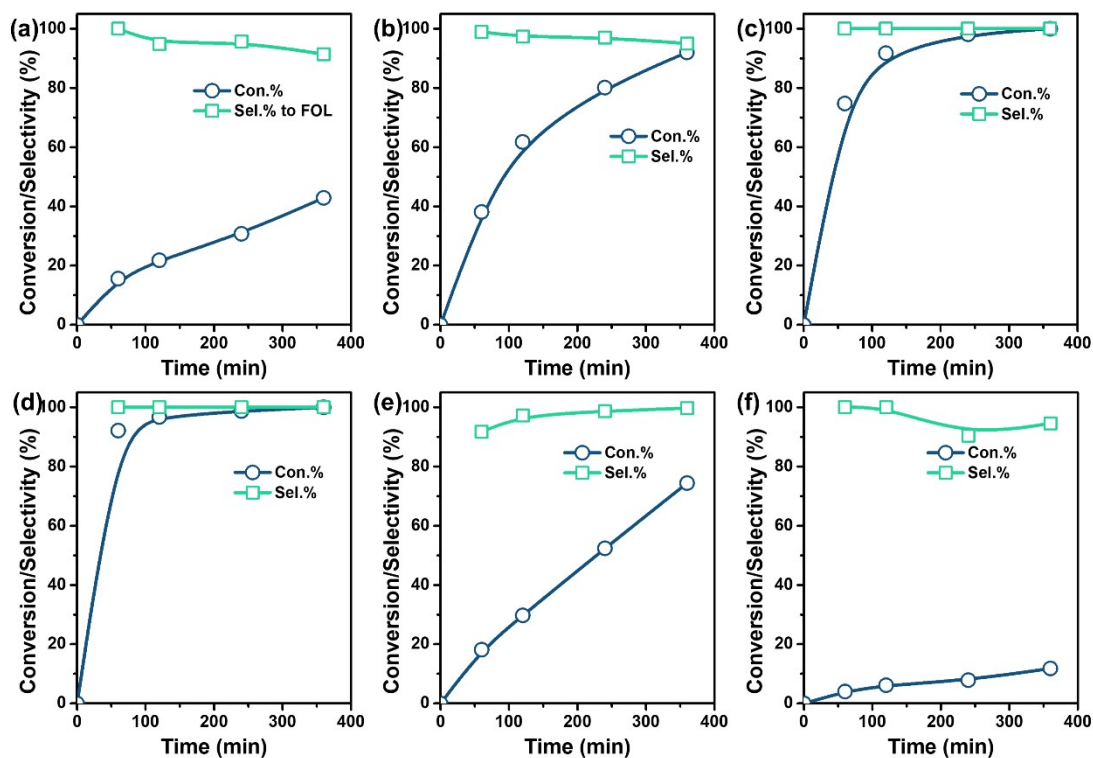




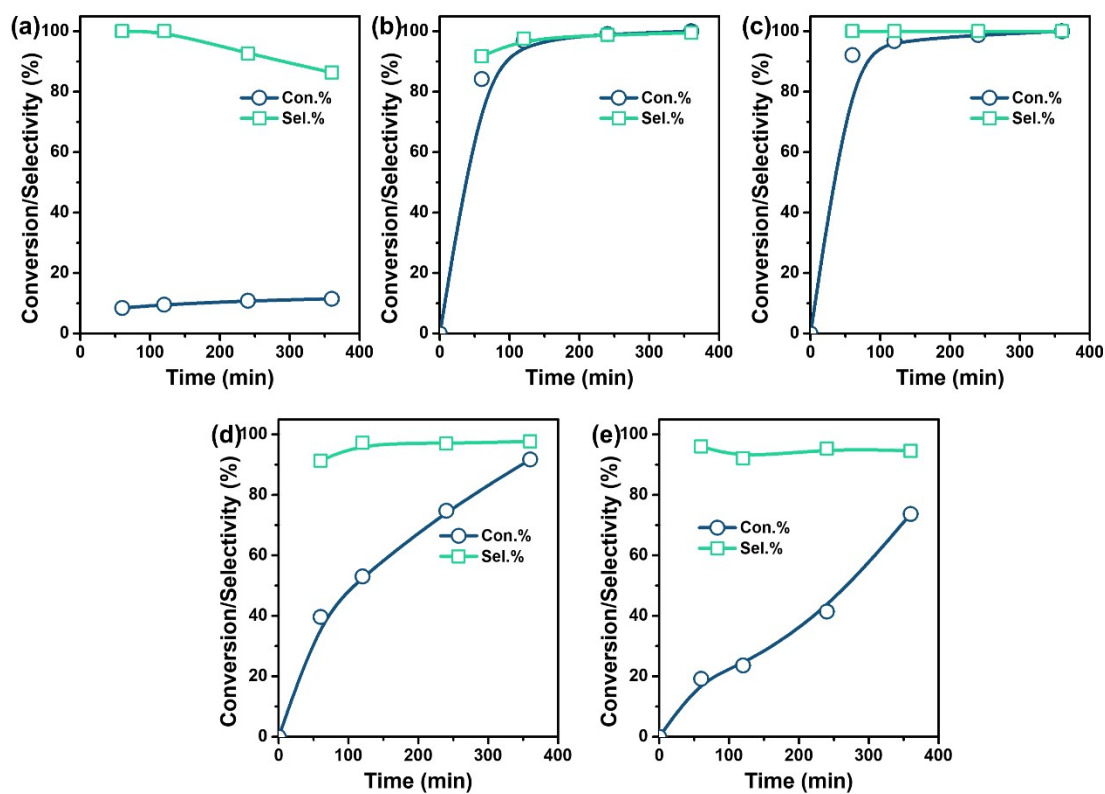
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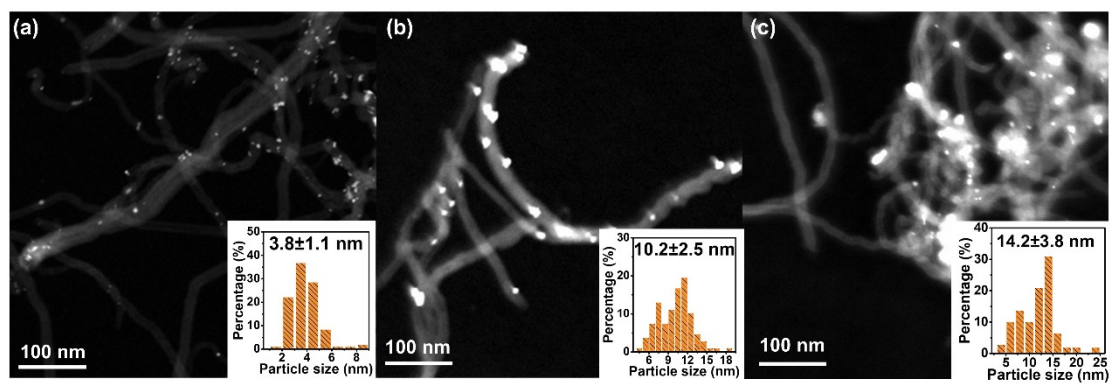
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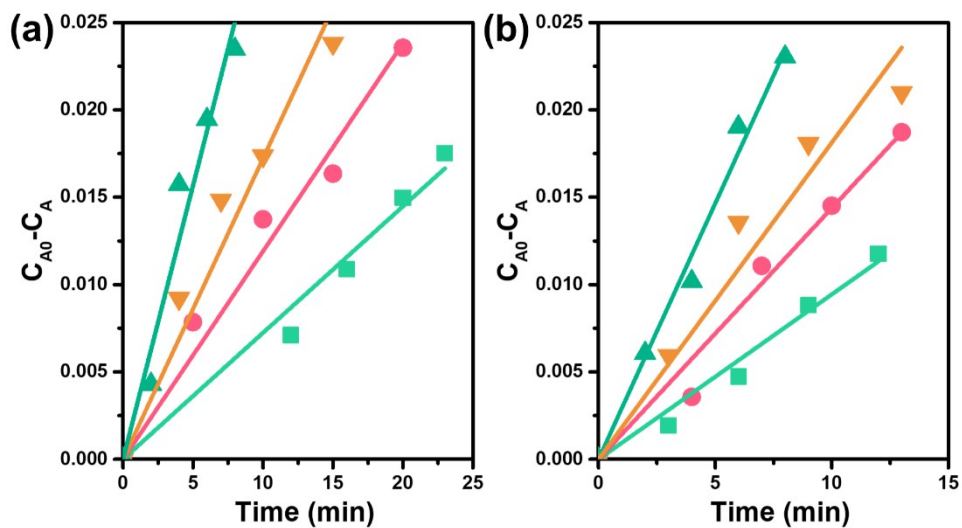


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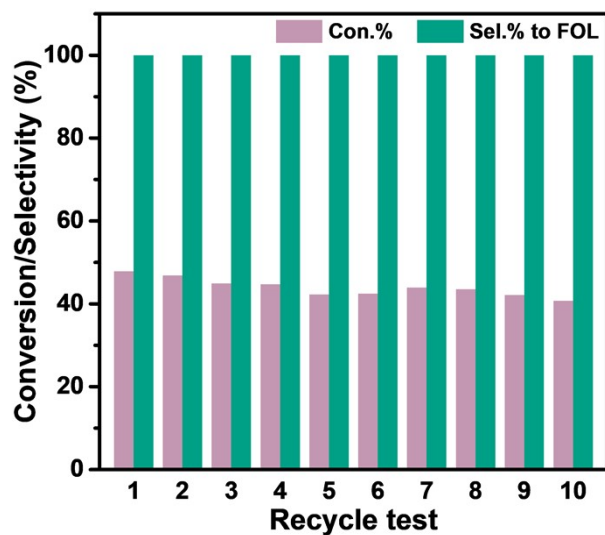


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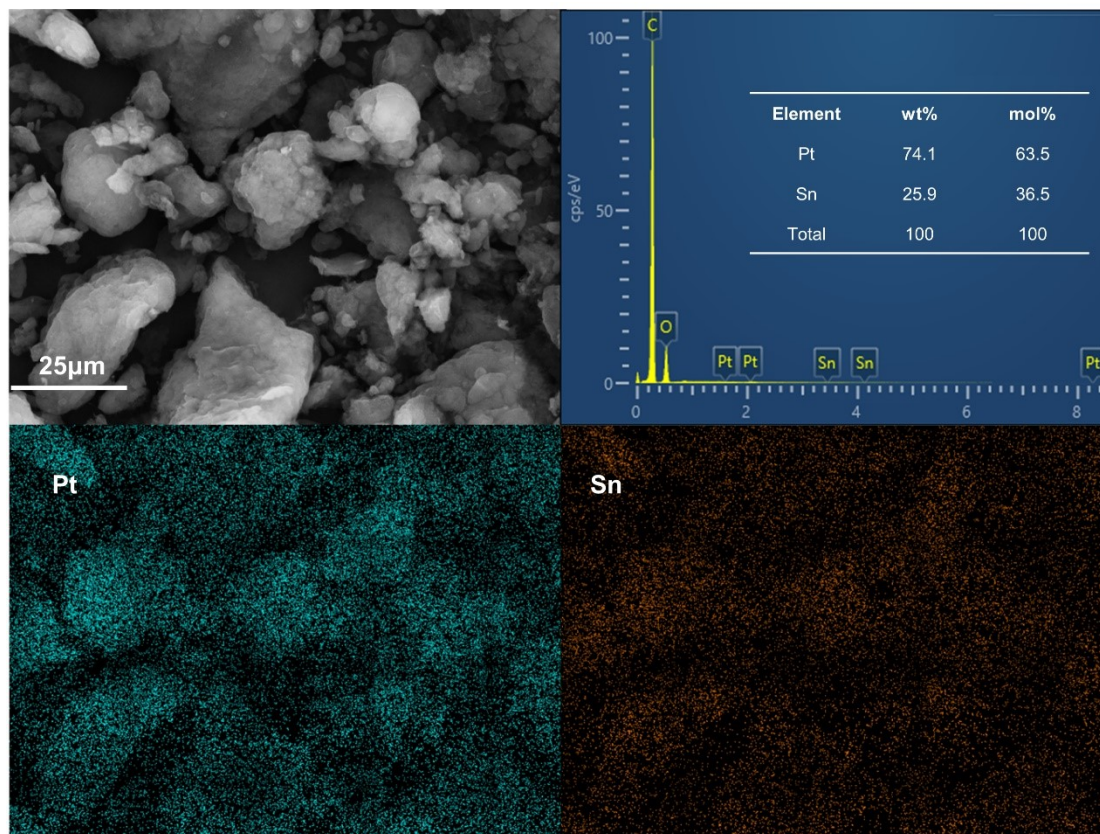
The inset images correspond to the particle size distribution.



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**Fig. S14** SEM image and the corresponding elemental EDX mapping of spent PtSn<sub>2.0</sub>/CNTs-100



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