Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Electronic Supplementary Information (ESI)

Synergistic effect of PtNi alloy loading on TiB_2 to construct SMSI catalyzing formic acid dehydrogenation

Hongliang Zhu,[a] Roong Jien Wong,[b, c] Xiangbowen Du,[a] Leilei Du,[a] Zhikang Jin,[a] KaiCheng Qian,[a] Junjie Song,[a] Renhong Li,[a] Wen Liu*[b, c]

[a] National Engineering Lab for Textile Fiber Materials and Processing Technology, School of Materials Science & Engineering, Zhejiang Sci-Tech University, Hangzhou, 310018, China.

[b] School of Chemical and Biomedical Engineering, Nanyang Technological University, 62 Nanyang Drive, Singapore 637459, Singapore.

[c] Cambridge Centre for Advanced Research and Education, 1 Create Way, #05-05, Singapore 138602, Singapore.

Corresponding Author

***wenliu@ntu.edu.sg**

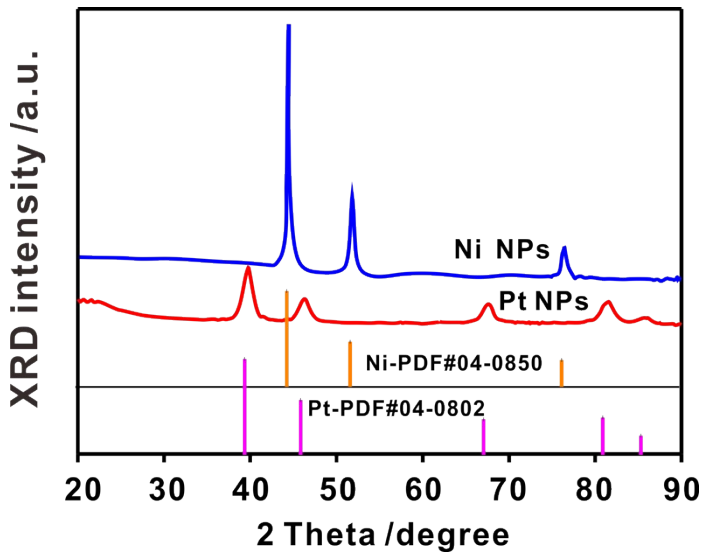

Figure S1. The XRD patterns of Pt NP and Ni NP.

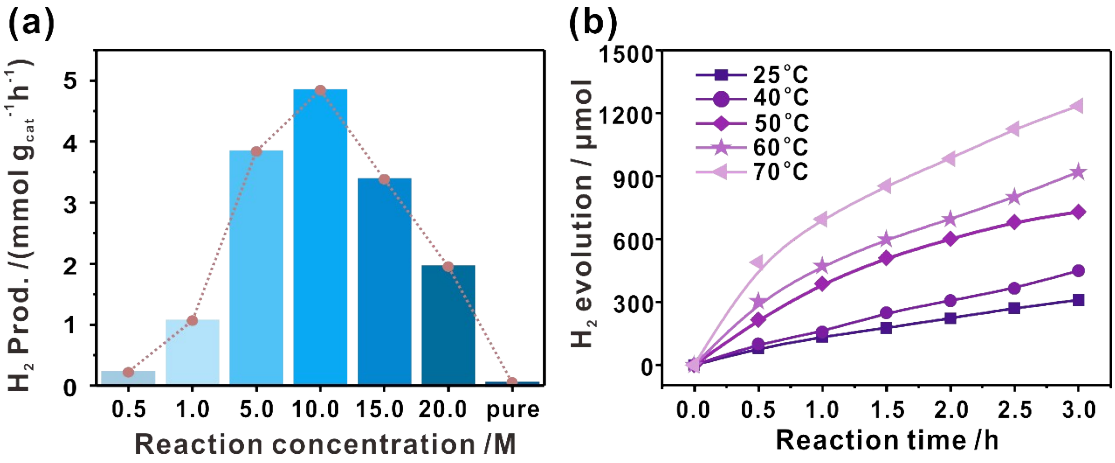

Figure S2. Investigation of reaction and synthesis parameters of Pt_3Ni_8/TiB_2 catalysed FA dehydrogenation. (a) Effect of formic acid using Pt_3Ni_8/TiB_2-600 °C reacting at 25 °C. (b) Effection fo reaction temperatures (25-70 °C), using Pt_3Ni_8/TiB_2-600 °C in 10 M FA solution.

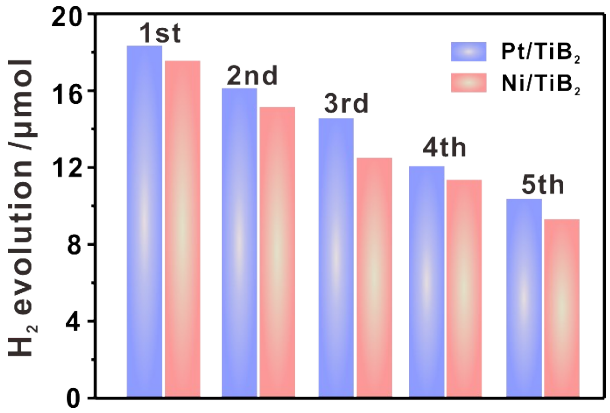

Figure S3. Reaction 5 consecutive reaction cycles, FA concentration: 10.0 M, catalyst = 20 mg, reaction temperature: 25 °C, reaction atmosphere: N_2, and calcination temperature: 600 °C, alloy load: 2.0 wt%: Pt/TiB_2-600 °C and Ni/TiB_2-600 °C.

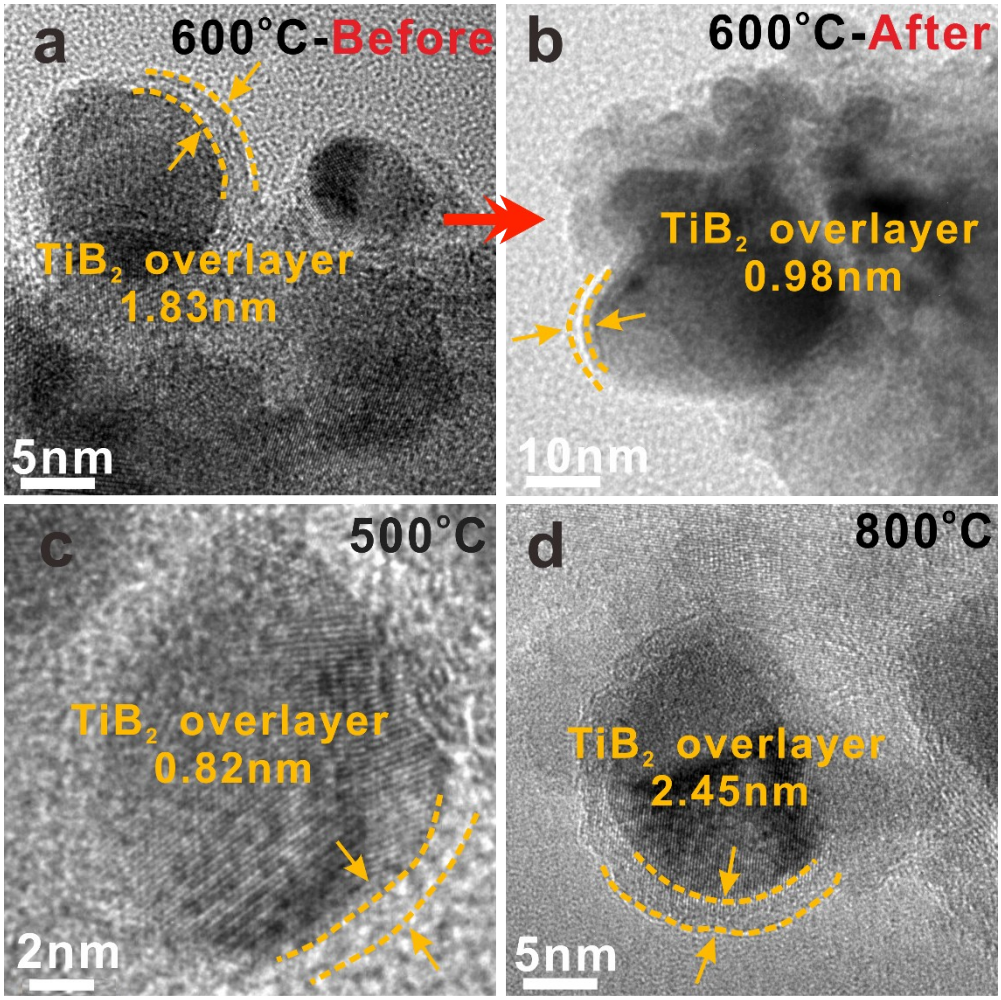

Figure S4. The TEM images of Pt_3Ni_8/TiB_2 with different calcination temperature. (a) 600 °C-Before the reaction. (b) 600 °C-After 5 cycle tests. (c) 500 °C. (d) 800 °C.

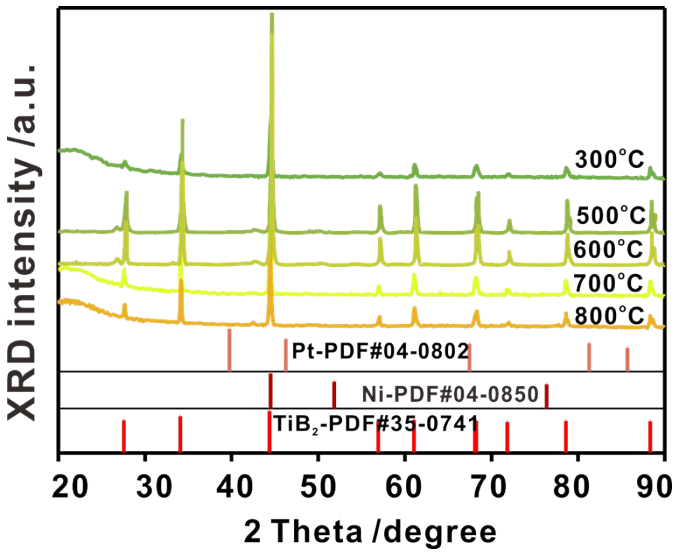

Figure S5. The XRD patterns of Pt_3Ni_8/TiB_2, which are calcined at different temperatures.

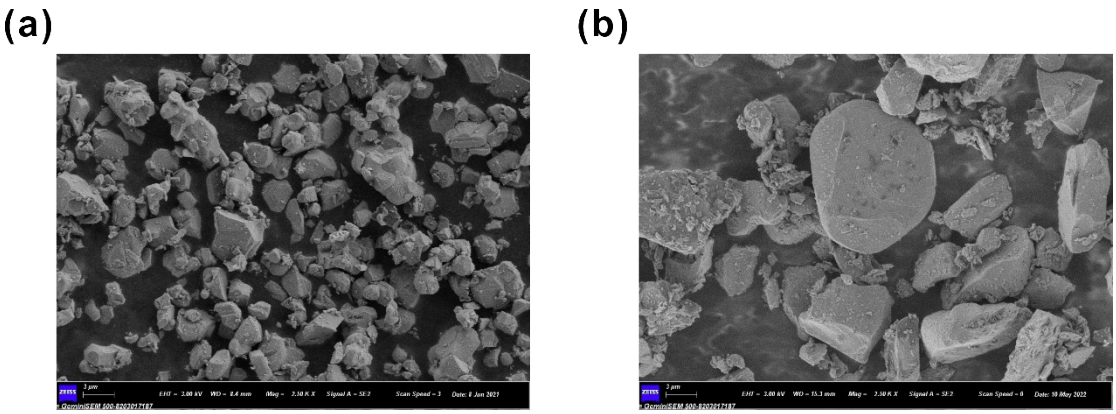

Figure S6. The SEM images of Pt_3Ni_8/TiB_2 with different calcination temperature. (a) 600 °C. (b) 800 °C.

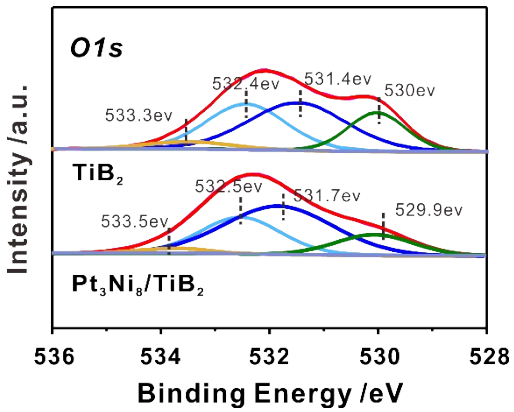

Figure S7. High-resolution XPS spectra of Pt_3Ni_8/TiB_2-600 °C at selected regions: O 1s.

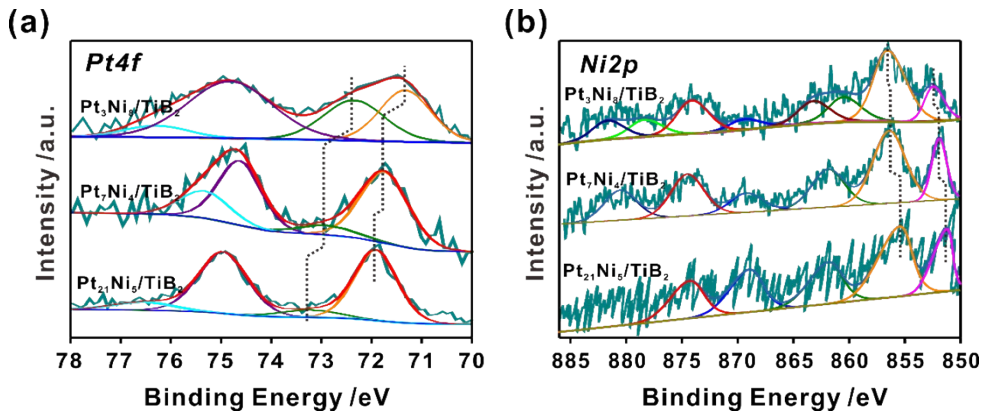

Figure S8. High-resolution XPS spectra of Pt_3Ni_8/TiB_2-600 °C, Pt_7Ni_4/TiB_2-600 °C, and $Pt_{21}Ni_5/TiB_2$-600 °C at selected regions: (a) Pt 4f, (b) Ni 2p.

Table S1. ICP test results of element contents of Pt and Ni in catalyst with different alloy ratios.

Entry	Catalyst	Pt W (%) [a]	Ni W (%) [b]	M_0(g) [c]
1	Pt_3Ni_8/TiB_2	0.44	0.36	0.0516
2	Pt_7Ni_4/TiB_2	1.63	0.28	0.033
3	$Pt_{21}Ni_5/TiB_2$	1.52	0.11	0.0275

a. Mass fraction of Pt element in sample catalyst, b. Mass fraction of Ni element in sample catalyst.

c. Test sample quality.

Table S2. ICP test results of element contents of Pt and Ni in catalyst with different alloy ratios.

Entry	Catalyst	T (K)	Metal loadings (wt %)	TOF (h^{-1})	Reference
1	Pt_3Ni_8/TiB_2	343	0.8	746	This work
2	PtRuBiOx/C	353	/	312	[1]
3	$Ni_{18}Ag_{24}Pd_{58}/C$	323	/	85	[2]
4	Pt/CNFs	398	1.0	108	[3]
5	PdCoNi/g-C_3N_4	298	1.0	33	[4]
6	Pt/C	358	1.0	205	[5]
7	PdNiAg/C	323	2.62	85	[6]

Notes and references

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